Imperial Bureau of Plant Breeding and Genetics

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following:—

Dr B. P. Pal	B. P. P.
Professor Y. Przyborowski	Y. P.
Dr J. Wishart	J. W.

* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VIII, No. 5.

Part 1. Empire Section

STATISTICS 519

1376. COCHRAN, W. G. 519.24
Recent advances in mathematical statistics. Recent work on the analysis of variance.
J.R. Statist. Soc. 1938 : **101** : 434–49.
The topics covered in this survey include the design of experiments, the discriminant function method, applications of the analysis of variance and the analysis of covariance. Most of the work described has been reviewed in "Plant Breeding Abstracts".

1377. 519.24:016
519.24:631.421
IRWIN, J. O. 519.24:575
Recent advances in mathe cal statistics. Bibliography of mathematical statistics (1935, 6, and first half of 1937).
J.R. Statist. Soc. 1938 : **101** : 394–433.
In addition to over 400 references on theory, this bibliography, covering the period from the end of 1934 to the middle of 1937, includes sections on agricultural and genetical applications.

BREEDING 575

1378. 575:633(41)
Research in plant breeding work at Corstorphine.
Scot. Fmr 1938 : **46** : p. 1134.
A report of the annual inspection of the Plant Breeding Station at Corstorphine by the Scottish Society for Research in Plant Breeding, giving a brief account of the work on oats, barley, wheat, potatoes, herbage plants, swedes and kales.

1379. JENKIN, T. J. 575:633(42·9)
The Welsh Plant Breeding Station in 1937.
J.R. Welsh Agric. Soc. 1937 : 136–38.
An outline is given of the developments in grassland research which preceded the establishment of the station in 1919 and the breeding work on oats, grasses and clovers is very briefly reviewed.

1380. 575:633(54)
BURNS, W. 63.00.15(54)
The progress of agricultural science in India during the past twenty-five years.
Reprinted from Progress of Science in India during the past twenty-five years, 1938 : 133–86.
A concise survey of plant breeding work in India during the past 25 years is included in this article. Among other topics reviewed are work on fruit culture and the application of statistics to agricultural experiments.

1381. 575:633(96.1)

Report by Sir Frank Stockdale, K.C.M.G., C.B.E., Agricultural Adviser to the Secretary of State for the Colonies, on his visit to Fiji, 1937.

Colon. Adv. Coun. Agric. Anim. Health 1938 : C.A.C. 365 : Pp. 62.

In this general survey of Fijian agriculture it is mentioned that the cane-breeding station maintained by the Colonial Sugar Refining Company raises about 10,000 seedlings annually. Other points of interest to plant breeders are the testing of hybrid coconut palms and of varieties of bananas, including seedlings from the West Indies. Minor crops worthy of trial are suggested and it is recommended that collections should be made of the numerous varieties of dalo (*Colocasia*) and yams which exist in the Colony, to test their food values and yields. The possibility of breeding work with these food crops should be considered. In view of the disease of *Colocasia* which occurs on the Gold Coast, it is suggested that planting material and, if available, viable seed of Fijian varieties might be sent there.

1382. BAGENAL, N. B. 575:633:007

Thomas Andrew Knight, 1759–1838. President, Horticultural Society of London, 1811–38.

J.R. Hort. Soc. 1938 : **63** : 319–24.

A brief account of Knight's life, on the occasion of the hundredth anniversary of his death.

GENETICS 575.1

1383. MATHER, K. 575.116

Crossing over.

Biol. Rev. 1938 : **13** : 252–92.

The topics covered in this comprehensive review include the time, place and mechanism of crossing-over and its correspondence with chiasma formation, the localization of chiasmata, the expression of crossing-over in diploids and autopolyploids, the relation of crossing-over to chromosome pairing and structural change and finally the control of crossing-over by natural selection.

An extensive bibliography is provided.

1384. HALDANE, J. B. S. 575.14:519.24

Indirect evidence for the mating system in natural populations.

J. Genet. 1938 : **36** : 213–20.

Statistical tests are given for testing the randomness or otherwise of mating in a population from the relative frequencies of genotypes in respect of a Mendelian factor. The application of the tests is illustrated by examples.

ORIGIN OF SPECIES, ETC. 576.16

1385. 576.16

The concept of species in biology.

Nature, Lond. 1938 : **141** : 998–1000.

A report of the presidential address by Dr J. Ramsbottom at the 150th anniversary meeting of the Linnean Society of London on "Linnaeus and the Species Concept" and of two symposia held on the two following days on "The Concept of the Species from Linnaeus to the Present Day" and "Geographical Isolation as a Factor in Species Formation".

CYTOLOGY 576.3

1386. 576.356:581.04

KOSTOFF, D. 576.356.5:581.04

Irregular mitosis and meiosis induced by acenaphthene.

Nature, Lond. 1938 : **141** : 1144–45.

The effect of crystals of acenaphthene on the growth of seedlings of grasses and cereals and other plants and on somatic nuclear division was similar to that of colchicine. At meiosis regular disjunction was prevented and variable numbers of nuclei were formed after the second division, leading to irregular pollen formation.

1387. Willis, J. C. 581.9:576.12
Some conceptions about geographical distribution and origin of species.
Proc. Linn. Soc. Lond. 1938 : **150** : 162–67.
Remarks on the author's "Age and Area" theory.

WHEAT 633.11

1388. Arnason, T. J. 633.11:575.127.2:576.356.5:575.11
The transference of *durum* and *dicoccum* characters to 21-chromosome wheat lines by crossing.
Canad. J. Res. 1938 : **16** : Sect. C. 174–81.
Lines with n = 21 chromosomes were obtained from hybrids of Marquis (*T. vulgare*) with Iumillo (*T. durum*) and Vernal (*T. dicoccum*) by back-crossing the F_1 to Marquis and then selfing. It was found that 11 out of 24 characters studied in the *vulgare-durum* cross and 6 out of 23 studied in the *vulgare-dicoccum* cross could be recovered in the emmer condition in the 21 chromosome lines. It therefore appears that these characters are unaffected by genes in the C genom. In a number of segregates most of the other characters studied differed from the *vulgare* form.
Comparing these results with those of an earlier investigation (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 863) it is concluded that many characters of *vulgare* wheat are determined by genes in the chromosome sets A and B, others by genes in all three sets.

1389. Percival, J. 633.11:576.1
The origin of wheat.
Dunns Seed Wheats, Salisbury 1938 : 4–5.
A brief popular account, putting forward the view that emmer wheat is derived from the related wild grass and bread wheat from a cross between emmer and *Aegilops cylindrica*.

1390. 633.11:576.312.34:576.312.315:576.354.4
Bhatia, G. S. 633.11–2.452–1.521.6:575.127.2
Cytology and genetics of some Indian wheats II. The cytology of some Indian wheats.
Ann. Bot., Lond. 1938 : **2** : (N.S.) 335–71.
The chromosome morphology, nucleolar behaviour and meiosis of Khapli emmer, *T. vulgare* var. *albidum* and certain rust-resistant strains derived from a cross between these two forms are described. Khapli emmer has two pairs of satellite chromosomes and *T. vulgare* and the hybrid strains have three. The maximum number of nucleoli in Khapli emmer is four and in the other two types six. Meiosis was regular in all forms except for the occurrence of cytomixis in the hybrid strains.

1391. Pal, B. P. 633.11:664.641.016
Milling and baking qualities of two new Pusa wheats.
Indian J. Agric. Sci. 1938 : **8** : 153–60.
Milling and baking tests with the new Pusa wheats, Pusa 120 and Pusa 165, carried out in England show that they are very near in respect of quality to Pusa 111 (one of the controls which has the reputation of being one of the highest quality wheats produced thus far in India). A detailed report by Dr E. A. Fisher is included as an appendix.

OATS 633.13

1392. 633.13:575(41·5)
Caffrey, M. 633.13 Glasnevin Success
Glasnevin Success—A promising new oat.
J. Dep. Agric. Éire 1938 : **35** : 39–41.
Glasnevin Success has been raised by the Plant Breeding Department of University College, Dublin from a cross between Victory and Record. It is a quick-ripening spring oat with a high yield of grain but rather low yield of straw, because of its short straw.

1393. Bose, R. D. 633.13:575(54)
Improved Pusa oats for fodder production.
Agric. Live-Stk India 1938 : **8** : 245–52.
The chief Pusa strains which are distributed on a large scale at present are B.S.1 and B.S.2, selections from Bihar oats, and Hybrids C and J, obtained by crossing Bihar selections with Scotch Potato oats. The results of yield tests with these and other strains are given.

1394. Caffrey, M. and
Carroll, P. T. 633.13–2.183–1.521.6:575
Lodging in oats.
J. Dep. Agric. Eire 1938 : **35** : 25–38.
The relation of a number of stem characters to lodging was studied, but it was found that they were too much affected by environment to be of use to the breeder. The root system of a variety was found to be related to its lodging resistance, the resistant varieties having roots spreading horizontally with a large proportion of unbranched, strong anchor-roots. This was also shown in the greater force required to pull plants of resistant varieties out of the ground.
The Plant Breeding Department of University College, Dublin has been concerned for some years with the breeding of prolific, strong-strawed oat varieties, their first one being Glasnevin Sonas, from a cross between Banner and Black Tartary. It has rather thin grain and has been crossed with other varieties to get rid of this defect. Glasnevin Ardri, from the cross with Victory 2 has plump, thin-skinned grain and is adapted to a wide range of soils. Sonas Marvellous 2/8, from the cross with Marvellous has an even stronger straw than Glasnevin Sonas and plumper grain than the latter, but is limited in adaptability to soils of high fertility. Promising stiff-strawed derivatives have also been obtained from crosses between Glasnevin Sonas and Potato, Glasnevin Sonas and Fluirse, Sonas Marvellous and Resistance, Glasnevin Sonas and Mansholt's and other crosses.

MAIZE 633.15

1395. Berg, D. J. van den, 633.15:575(68)
Garderen, J. van and 633.15.00.14(68)
Cutler, J. V. 633.174.00.14(68)
A review of the results of plot experiments and field investigations.
1st Progr. Rep. Kroonstad Summer-Cereal Exp. Sta. (1927–1936) : 1938 : Pp. 59.
The aims of the station include crop improvement by breeding and the determination of the most suitable varieties.
Breeding work is confined to yellow dent and yellow flint maize, the method used being the pooling of inbred lines to form a synthetic variety.
The results of variety trials with maize and sorghum are given.

1396. 633.15:576.356.2:537.531
Catcheside, D. G. 633.15:576.356.2:535.61–31
The bearing of the frequencies of X-ray induced interchanges in maize upon the mechanism of their induction.
J. Genet. 1938 : **36** : 321–28.
The frequencies of different simple and complex segmental interchanges produced by X-ray and ultra-violet irradiation of maize pollen are given. By making a number of assumptions, it is argued that these results show that chromosomal rearrangements occur when two or more chromosome regions in contact are affected by the same X-ray hit rather than by the random rejoining of independently broken chromosomes.

1397. Brieger, F. G.,
Tidbury, G. E. and
Tseng, H. P. 633.15:581.331.2:575.11
Genetic control of gametophyte development in maize. II. The quarter test.
J. Genet. 1938 : **36** : 17–38.

If two genetically different types of pollen bring about fertilization in a ratio which varies with the final length of the pollen-tube, it can be concluded that their pollen-tube growth rates are different and therefore that pollen-tube competition is operating. This principle is applied to maize by dividing the ear into four quarters from top to bottom: pollen-tubes fertilizing ovules in the bottom quarter will be longer than those fertilizing the top quarter. A method of analysis of χ^2 is developed for comparing the ratios obtained in different quarters. By the use of this "quarter test" it is shown possible to detect the effect of the gametophyte factor pair *Ga2–ga2* (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1110). From experiments with families segregating for the genes *c* and *sh* a third gametophyte factor pair *Ga3–ga3* is postulated, believed to lie about 10 units to the right of shrunken in the ninth chromosome. Of pollen from the heterozygote *Ga3/ga3* the percentage of *ga3* pollen-tubes functioning in the fourth quarter is about 37 per cent and in the other three quarters 50 per cent.

In the segregation of yellow versus white in a cross between White Tirol Flint (♀) and a heterozygous Golden Bantam derivative (♂) for deep yellow endosperm, some irregularities were noted but not explained. Changes in dominance of deep and pale yellow were noted in the same cross.

MILLETS AND SORGHUMS 633.17

1398. Rangaswami Ayyangar, G. N. and
Krishna Rao, P. 633.171:575.11
Studies in the millet, *Panicum miliaceum*, Linn.
Madras Agric. J. 1938 : **26** : 195–206.

The botanical characters of *P. miliaceum*, anthesis and the method of artificial cross-pollination are described.

Three types of plant colour are distinguished: green throughout (*ppii* or *ppII*), light purple (*PPii*) and purple (*PPII*), *P* being a dominant factor for light purple and *I* a dominant intensification factor. Four degrees of hairiness are recognized, densely hairy, hairy, sparsely hairy and hairless, the last having a few hairs on the lower leaf sheaths and nodes only. Three factors, H_1, H_2 and H_3, operating cumulatively account for the inheritance of these types, the hairless type being $h_1h_2h_3$.

The inheritance of "grain colour" (actually glume colour) was also studied. Starting from buff yellow, a dominant factor *O* produces dark olive grey; *L*, another dominant, dilutes either of these colours to produce light buff yellow and light olive grey. A third dominant factor *I* inhibits the expression of colour in the glume and limits it to the base in the palea, producing the grain colours ivory grey and ivory yellow. The grain colour reddish orange is a simple recessive to buff yellow, the factor pair concerned being termed B_f–b_f.

1399. 633.174:575(54.5)
633.174 J.S. No. 20
633.174 J.S. No. 21

Improved fodder juars.
Seas. Notes Punjab Agric. Dep. 1938 : **17** : 50–51.
Leafl. No. 140.

Brief descriptions are given of J.S. No. 20 and No. 21, fodder juars (*Sorghum*) selected by the Department of Agriculture, Punjab.

1400. Rangaswami Ayyangar, G. N.,
Panduranga Rao, V. and
Ponnaiya, B. W. X. 633.174:575.11.061.6
Green and bluish-green seedlings in sorghum.
Curr. Sci. 1938 : **6** : 556–57.

While typical Indian grain sorghums of the sub-series *Durra* have green seedlings, many wild species and African grain sorghums of the *Caffra* and *Guineensia* sub-series have blue-green seedlings. Blue-green is dominant over green, the dominant factor being named C_{BL}.

1401. Hutchinson, J. B.,
Panse, V. G.,
Apte, N. S. and
Pugh, B. M. 633.174:575.42:631.421
Studies in plant breeding technique. III. Crop analysis and varietal improvement in Malvi *jowar* (*Andropogon sorghum*).
Indian J. Agric. Sci. 1938 : **8** : 131–52.

Field studies in *jowar* (*Andropogon sorghum*) in Central India showed that Snowden's classification of this crop was inadequate to the needs of agricultural botany. With but few exceptions the *jowars* of Central India may be regarded as a single, variable, interbreeding crop population. A crop analysis carried out in cultivators' fields in the Malwa and Nimar tracts disclosed the fact that the differences in crop composition between the two tracts were small compared with those revealed in a previous survey of the cotton crops of these two tracts. The variation from sample to sample in the same area was however much greater.

The supplementing of progeny row selection by tests of small bulks of seed left over after selection for subsequent progeny row trials from the best progenies, in randomized block trials, was found to be useful in discovering valuable strains which would otherwise have been discarded.

The paper concludes with a discussion of the most suitable methods of studying the usually highly variable populations of the indigenous Indian crops. B. P. P.

1402. Rangaswami Ayyangar, G. N. and
Venkataramana Reddy, T. 633.174:581.46:575.11
The inheritance of basal feathered stigmas (and basal barbed subules) in sorghum.
Madras Agric. J. 1938 : **26** : 123–26.

In certain sorghum varieties from Central and East Africa the stigma is feathery at the base only and when the variety concerned is awned, the subule of the awn is barbed at the base only. Normally the whole of the stigma is feathery and the whole of the subule is barbed. The normal condition is inherited as a simple dominant over the abnormal, the symbol St_{bf} being assigned to the dominant factor. This character is inherited independently of the sheath colour factors P and Q and of the grain colour factors B_1, B_2 and W.

RICE 633.18

1403. 633.18:575(54.8)
Some new strains of paddy.
Mysore Agric. Cal. 1938 : 43–44.

Brief descriptions are given of five selections which are offered to raiyats for trial.

ROOTS AND TUBERS 633.4

1404 633.42:575.127.5:635.15:575.129
633.42:575.127.5:581.162.5:576.354.4
Howard, H. W. 635.34:575.127.5:635.15
The fertility of amphidiploids from the cross *Raphanus sativus* x *Brassica oleracea*.
J. Genet. 1938 : **36** : 239–73.

Further studies on the Cambridge *Raphanobrassica* material (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1119) are reported.

At meiosis in the F_1 an average of 2·2 bivalents per cell was observed, with a range from 0 to 4;

in one cell $3_{II} + 1_{IV}$ were found. Secondary association of univalents was also observed, but never in such a position that they might be mistaken for bivalents. The bivalents had usually one sub-terminal chiasma. Anaphase bridges, presumably due to inversions, were noted. Some plants had long, others short chromosomes at meiosis. Occasional trivalents occurred, in two cases with a triple chiasma, indicating reduplication within one of the parental sets.

Meiosis in the amphidiploid was studied in one of the most fertile F_3 plants. The chiasma frequency was about equal to the sum of the parental frequencies. Univalents, trivalents and quadrivalents occurred but the frequency of multivalents was not easily estimated. Anaphase bridges were rather frequent, indicating that inter-parental chromosome pairing is rather frequent. At second metaphase cells with 17 and 19 chromosomes in the two plates were seen and though the majority of the F_4 plants had 36 chromosomes, others had 33, 34, 35 and 37.

The effect on fertility of bivalent formation in the F_1, with and without inversion bridges, and of inter-parental pairing instead of regular intra-parental in the amphidiphoid generation is considered. It is shown that segregation for fertility, of the type expected under the hypotheses advanced, was in fact observed. An improvement in fertility in succeeding generations occurred, apparently due at least to some extent to selection for fertility. The F_2 plant used had a fertility of about 10 per cent, the F_3 plant (the most fertile of its generation) about 23 per cent; the highest fertility in F_4 was 40 per cent while in F_5 plants with more than 50 per cent fertility were obtained. This still rather low fertility it is pointed out suggests that the economic application of amphidiploidy may be restricted to crops in which seed fertility is unimportant.

The results are compared with Karpechenko's and it is suggested that the lower fertility of the present material and the occurrence in the F_2 generation of plants with less than 36 chromosomes (Cf. "Plant Breeding Abstracts", loc. cit.) may both be attributed to the more frequent bivalent formation in the F_1 of the present material.

1405. Salaman, R. N. 633.491:575

The present state and future development of potato breeding.

Indian J. Agric. Sci. 1938 : **8** : 119–29.

After a brief survey of the history of the potato since its introduction into Europe at the end of the sixteenth century it is pointed out that during a period of three-and-a-half centuries breeders have been raising varieties by the simple process of re-arrangement of the same fundamental qualities with which they started. In the course of this process, characters which appeared to be economically undesirable have been eliminated while those which enhanced the immediate value of the plant as a saleable crop have been retained. A list is given of the more important morphological and physiological characters which have been or are in the process of being lost, and the author estimates that from the genetic point of view, this represents a loss of not less than a hundred separate genes. It is pointed out that genes which may seem to control the expression of any one character may also dictate the characteristic type of pattern behaviour involved: thus in eliminating by breeding characters such as deep eyes, long stolons etc. it is possible that genes which are of importance in maintaining vigour, frost resistance etc. may have been lost.

Reference is made to the change in the outlook of potato breeding and the new interest aroused in this crop as a result of the Russian discoveries in South America. Modern work on breeding late-blight resistant potatoes is illustrated by examples from the author's own work. Other problems in potato production, especially those of the virus diseases, are also touched upon. B. P. P.

FIBRES 633.5

1406. 633.51:575(54)

Annual Report of the Indian Central Cotton Committee, Bombay, for the year ending 31st August, 1937.

Bombay, 1938 : Pp. 134.

The progress of the different schemes (Cf. "Plant Breeding Abstracts", Supplement II and

Vol. VII, Abst. 1121) is reviewed. In Bombay a scheme for the improvement of Wazad and Mathio cottons was commenced on May 1st, 1937 with the object of improving the cotton of the large Dholleras tract. Yield, quality and earliness are the immediate aims of the work on Wagad cotton, the methods to be used being selection and hybridization with Iranian cottons, a collection of which has recently been made. Another new scheme in Bombay is concerned with breeding wilt-resistant cottons in the Surat area. This began in April 1937 and selections have been made for testing.
In an appendix information is given on the progress in the introduction of improved varieties of cotton.

1407. 633.51;575(54·5)
633.51 L.S.S.

L.S.S.—A new cotton of *Hirsutum* type.
Seas. Notes Punjab Agric. Dep. 1938 : **17** : 46–49.
Leafl. No. 139.

The common Punjab-American cotton variety 4-F is subject to periodic failures. During the failure in 1926 a plant was observed in a field of 4-F at Lyallpur Experimental Farm with bolls opened normally. The seed of this plant was multiplied to form the new variety L.S.S. (Labh Singh's Selection). It outyields 4-F, has better lint qualities and is resistant to jassids.

1408. Singh, S. C. and Raj, L. D. 633.51:575(54·5)
633.51 *119-Sanguineum*

A new variety of Desi cotton for Multan district.
Seas. Notes Punjab Agric. Dep. 1938 : **17** : 32–34.

The variety 119-Sanguineum, a selection of the *Multani* or *Sanguineum* type yields more than 39-Mollisoni, is quick-growing, drought-resistant, has soft lint nearly equal in length to *Mollisoni* and has a high ginning percentage (about 38 per cent.) It was bred at the Multan Agricultural Farm.

1409. Templeton, J. 633.51:575(62)

A reply to Dr. Mason's note on the technique of cotton breeding.
Emp. Cott. Gr. Rev. 1938 : **15** : 228–29.

The author points out that modern methods of plant breeding are applied to cotton in Egypt. Selection in the field is scarcely used at all and hybridization has been successfully exploited. The Target Diagram is used in making single plant selections and miniature chequers for estimating yield in the earlier stages of breeding. An organized seed control and renewal system ensures the commercial purity of the varieties.

1410. Gates, R. R. 633.51:576.1

The origin of cultivated cotton.
Emp. Cott. Gr. Rev. 1938 : **15** : 195–200.

A brief review of taxonomic, genetical and cytological evidence on this problem.

1411. Hutchinson, J. B. 633.51:581.9:576.1

The distribution of *Gossypium* and the evolution of the commercial cottons.
Pl. Breed. Pap. No. 1 Indian Cent. Cott. Comm. Pp. 15.

An account is given of the distribution and relationships of the wild and cultivated species of *Gossypium* and it is shown that the great extensions in the distribution have led to rapid evolution, which has run parallel in the different species, producing early, annual, sympodial types from perennial, highly monopodial bushy forms.
The amphidiploid origin of the New World cottons with n = 26 chromosomes is also discussed.

SUGAR PLANTS 633.6

1412. Sethi, R. L.
Pramanik, B. N.
Khan, A. D. and 633.61:575(54)
Rao, R. B. 633.61:575.127.5:633.174
Improved methods of cane cultivation in the United Provinces (1936).
Bull. Dep. Agric. Agra Oudh 1937 : No. 72 : Pp. 114.

This bulletin contains a section on the sugar-cane breeding work at Coimbatore and also gives a brief account of the performance of sugar-cane x sorghum hybrids at Shahjahanpur.

1413. Venkatraman, T. S. 633.61:575(54.8)
Hybridization in and with the genus *Saccharum* (its scientific and economic aspects).
25th Indian Sci. Congr., Calcutta 1938 : Presidential Address. Sect. IX, Agric. : Pp. 18.

The taxonomic position of *Saccharum* is indicated and the wild and cultivated forms are briefly described.

Dealing with inheritance in *Saccharum* the wide variation within seedling families is mentioned. The chief value of inbreeding is believed to be in accentuating desired characters.

Although some intervarietal crossing in *S. spontaneum* is being performed at Coimbatore for cytological studies, the hybridization work there has been mainly interspecific, chiefly with *S. officinarum, S. spontaneum* and *S. Barberi.* An important development has been intergeneric crosses and the sorghum and bamboo hybrids are briefly described. A strange feature of the sugarcane-bamboo hybrids has been that different bamboo characters are distributed among the different F_1 plants.

1414. Dodds, H. H. 633.61:575(68)
The revolution in cane varieties in South Africa.
S. Afr. Sug. J. 1938 : **22** : 201–13.
Also Proc. 12th Annu. Congr. S. Afr. Sug. Tech. Ass. 1938 : 6–14.

An account is given of the varieties introduced by the South African Sugar Experiment Station.

A more recently adopted line of work is the raising of seedlings from imported seed tassels. In 1930 seed of five C.P. varieties was received from Canal Point, Florida, followed in 1932 and again in 1937 by seed of Uba Marot crossed with P.O.J. 2878 and noble varieties, from Mauritius. The crosses P.O.J. 2725 x Co. 214, P.O.J. 2725 x Co. 281 and P.O.J.2725 x Co. 301 were made for the Station at Coimbatore. No varieties have as yet been released, from the seedlings thus produced.

1415. 633.61:575(88)
Williams, C. H. B. and 633.61.00.14(88)
Cameron, C. 633.61:575.127.5:633.174
Field experiments with sugar cane. VII.
Sug. Bull. Dep. Agric. Brit. Guiana 1938 : No. 7 : Pp. 139.

Extensive data are given on the results of variety trials, in which new varieties were included. It is mentioned that D.166/34, a seedling from a cross between P.O.J.2878 and *Sorghum* has shown such outstanding vigour that it has been distributed for observation under estate conditions.

STIMULANTS 633.7

1416. 633.71:575(68.9)
Brain, C. K. 633.71–2.8–1.521.6:575
Report of the Tobacco Research Board for the year ending December 31st, 1937.
Rhod. Agric. J. 1938 : **35** : 350–78 ; 424–42.

Contains the report on plant breeding by Dr A. A. Moffett.

Single plant selection within varieties has been continued. The application of the principles

of replication and randomization to progeny tests is suggested. A variety trial in the form of two Latin squares was carried out to compare seven varieties.
The varieties White Stem Orinoco, Jamaica Wrapper, Ambalema and the F_1 hybrids Ambalema x White Stem Orinoco and Ambalema x Jamaica Wrapper were tested for mosaic resistance in randomized blocks. Two rows were laid down in each plot and one row was inoculated with mosaic. Ambalema was completely resistant, White Stem Orinoco and Jamaica Wrapper were susceptible and gave reduced yields, while the F_1 hybrids, though susceptible, showed less final effect than the susceptible varieties and are apparently intermediate between their parents.
Cytological studies were made on White Stem Orinoco, Jamaica Wrapper, Vumba, Ambalema and certain hybrids between these varieties. Evidence of structural hybridity was obtained in each case, and it is pointed out that this may account for the repeated appearance of aberrant types even after years of inbreeding and selection. Selection work must therefore be continuously pursued.
The programme for 1937–38 follows similar lines and includes an experiment to ascertain the most suitable size and shape of plots for tobacco field experiments.

1417. Tubbs, F. R. 633.72:575.42
Nursery selection.
Tea Quart. 1938 : **11** : 8–21.
An account of Wellensiek's work on this subject (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 203) and its application in Ceylon.

1418. Subba Rao, M. K. 633.72:576.312.35:576.354.4
Chromosome behaviour in the tea plant (*Camellia thea*).
Annu. Rep. Unit. Plant. Ass. S. India Tea Sci. Dep., Nilgiris 1937/38 : Pp. 15.
From South Indian seed the diploid chromosome number $2n = 30$ was confirmed and in the varieties Chapleton, Bonaccord and "China" $n = 15$ was found. Meiosis in the variety Chapleton is described in some detail. It was quite regular except for occasional lagging at first anaphase.

1419. Beard, F. H. 633.79:575(42)
A review of hop investigations at East Malling.
Annu. Rep. E. Mall. Res. Sta. (1937) : 1938 : 161–65.
Inter alia a brief account is given of the method of testing the new varieties bred at Wye. A collection of commercial varieties is maintained and different strains of the same variety are compared.

1420. Ford, J. S. and
Fletcher, L. 633.79:581.6:575(42)
Brewing trials with new varieties of hops 1936 and 1937. Growths raised by Prof. E. S. Salmon, at Wye College, Kent.
J. Inst. Brew. 1938 : **44** : 331–32.
The hops tested were H.H.44, O.W.28, C.9*a*, O.L.12 and I.I.149. Special attention is drawn to their very high resin content and consequent high preservative values.

RUBBER PLANTS 633.91

1421. 633.912:575
Murray, R. K. S. 633.912–1.541.11
Planting material.
Rubb. Res. Scheme (Ceylon) 1938 : **15** : 14–23.
The merits of different types of planting materials are discussed. In connexion with budded rubber, the possibility of genetical control of the stock as well as the scion is mentioned.

FRUIT TREES 634

1422. 634.11:575.183
TYDEMAN, H. M. 634.13:575.183
The influence of different pollens on the growth and development of the fruit in apples and pears. I. A progress report on experiments carried out during 1937.
Annu. Rep. E. Mall. Res. Sta. (1937) : 1938 : 117–27.
The development of fruits of six varieties of apples and five varieties of pears pollinated in each case by two or more different varieties was studied. Differential effects of the pollen were found, in some cases of sufficient magnitude to be economically significant.

SMALL BUSH FRUITS 634.7

1423. 634.75:575(42)
634.75 Early Cambridge
Report on experiments on strawberries 1923–1937.
Botley Exp. Fruit Sta. 1938 : Pp. 66.
In the introduction it is mentioned that seedlings were raised from crosses of William Belt, a vigorous variety from Canada, with Royal Sovereign, Sir Joseph Paxton, Laxton and Madame Lefebvre. The seedlings were discarded after three years, none being comparable with the best existing varieties. Seedlings from the Cambridge Horticultural Research Station were received for trial in 1932 and one of them named Early Cambridge was distributed from Botley in 1937.
The bulletin includes accounts of variety and strain trials.

1424. 634.771(96.1+72.98)
PARHAM, B. E. V. 634.771:001.4
New banana varieties for Fiji.
Agric. J. Fiji 1938 : **9**(2) : 12–14.
Brief descriptions are given of the varieties I.C.2 (hybrid of Gros Michel and *Musa acuminata*), Giant Chinese, Congo and Lacatan, received from Trinidad. Lacatan is indistinguishable from the local variety Veimama Veimama.

VEGETABLES 635

1425. BOND, T. E. T. 635.64:001.4
On the nomenclature of the currant tomato, *Lycopersicum pimpinellifolium* Mill.
Proc. Linn. Soc. Lond. 1938 : **150** : 181–87.
The confusion in the nomenclature of the currant tomato is expounded and *L. pimpinellifolium* Mill. is given as the correct name.

1426. VILJOEN, N. J. 635.655:581.192:575.11
An investigation into the composition of the soybean in South Africa.
Sci. Bull. Dep. Agric. S. Afr. 1937 : No. 169 : (Chem. Ser. No. 151) : Pp. 68.
Varietal differences in oil and protein content are demonstrated and the effect of different environmental factors is also described.
In three crosses the oil and protein content of the F_1, F_2 and to a limited extent of the F_3 was studied. No simple factorial scheme of inheritance of these characters is advanced, though it is pointed out that in one cross the frequency distribution in F_2 for oil content was bimodal and might be interpreted as a segregation into 9 high : 7 low oil content. In this cross there was transgressive segregation for high oil content, tentatively confirmed in the F_3, and for low protein content. The other two crosses showed no transgression. Two of the varieties used in these crosses were selections made at Potchefstroom, P.449 a big yellow-seeded non-shattering variety, and P.258 a brown-seeded non-shattering variety.
A strong, significant, negative correlation between oil content and protein content was found, whether the variation was due to environmental causes or to genetical, as in the F_2 generations of the crosses.

1427. Koller, P. C. 635.656:576.356:575.11
Asynapsis in *Pisum sativum.*
J. Genet. 1938 : **36** : 275–306.

Cytological studies on five plants of an asynaptic line of *Pisum sativum* are reported.

In chromosome morphology the asynaptic plants differed from normal peas in having the satellites borne on the long instead of the short arm of the satellited chromosome pair and in possessing a pair of chromosomes with median constriction. The asynaptic plants differed among themselves in respect of contraction of the mitotic chromosomes and of relational coiling. Polyploid cells were common in their root tips, apparently owing to some defect in the spindle mechanism.

At the first division of meiosis the mean number of bivalents formed varied from 3·9 to 4·5 in sister plants. The bivalents formed had fewer chiasmata than those of normal peas. The frequency of bivalents per cell was positively correlated with the frequency of chiasmata per bivalent. The co-ordination in position of pairs of univalents suggested that they had been paired during prophase. The univalents sometimes lagged at the first division and might divide at either. Pollen grain formation was irregular.

One of the asynaptic plants was a trisomic and in another anaphase bridges produced by an inversion were found in one anther. The inversion, judging by the frequencies of first and second division bridges, is short and some distance from the centromere. In the latter plant, transverse division of the centromere was observed in some chromosomes at the second division.

The various abnormalities are interpreted as due to a reduction in precocity, genetically controlled.

In an appendix by Miss C. Pellew the origin of the asynaptic *Pisum* is briefly described. The condition is inherited as a simple recessive.

Part II. Foreign

STATISTICS 519

1428. FISCHER, G. J. 519.24:631.421
Interpretación estadistica de experiencias biológicas. (**Statistical interpretation of biological experiments**).
Arch. Fitotécn. Uruguay 1937 : **2** : 85–106.
The new statistical methods of Fisher, Pearson and others are referred to, with examples of their use in genetics and field experiments.

BREEDING 575

1429. TERAO, H. 575:633
(**Plant breeding—investigations into a new line of thought**).
Bot. and Zool. 1935 : **3** : 217–24.
The necessity for extending the sphere of plant breeding research to include physiological, ecological and agronomic factors is strongly urged and instances of investigations on cold resistance in rice, seed germination and the morphology and ecology of seedlings and varieties are cited in exemplifying the writer's view.

1430. GESCHER, N. v. 575:633(4)
Organization and present state of plant improvement in the different countries.
Int. Rev. Agric. 1938 : **29** : T173–79.
The International Institute of Agriculture is preparing a survey of the organization and present state of plant improvement work throughout the world, covering both official and privately-owned establishments. The present article is the first of a series based on the preliminary studies and deals with European countries having a maritime climate, Great Britain, Belgium, Holland, Denmark, Sweden, Finland and Estonia.

1431. CÂMARA, A. de Souza da 575:633(43)
As investigações geneticas no Kaiser Wilhelm Institut—o ambiente de trabalho em Dahlem. (**The genetical investigations at the Kaiser Wilhelm Institute and the conditions of work at Dahlem**).
Rev. Agron., Lisboa 1937 : **25** : 56–71.
The work on genetics and plant breeding is described and the atmosphere in which the work is carried out is praised.

1432. KOCH, L. 575:633(43)
Reseña sobre recientes trabajos efectuados en el Instituto de Investigaciones Genéticas de Müncheberg (Alemania). (**A review of the work actually carried on at the Kaiser Wilhelm Institut für Züchtungsforschung in Müncheberg**).
Arch. Fitotécn. Uruguay 1937 : **2** : 204–16.
An account is given of the equipment, programme and achievements of the institute.

1433. JUR'EV, V. Ja. 575:633(47)
(**Breeding work of the Kharkov Agricultural Experiment Station**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 46–48.
The early selection work of this station resulted in the production of large numbers of superior types of soya beans, cereals and sunflowers. More recently the need for speeding up breeding operations has been emphasized and the possibility of evolving methods to deal rapidly with the testing of the very numerous varieties produced by large scale breeding operations is discussed. Seed production and the methods used for self and cross-pollinated crops at the station are also mentioned with a final recommendation for the localization of variety tests in the various regions for which particular types are destined.

1434. 575:633(47)
PISAREV, V. E. 631.531.12(47)
(**Breeding and seed raising on new lines**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 16–18.
A popular article on some defects in the organization of plant production in the testing and regional distribution of new varieties and in seed production in the U.S.S.R. with suggestions for improving future methods.

1435. 575:633(47)
RUDNITSKII, N. V. 631.531.12(47)
(**A new era in plant breeding and seed raising**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos. 8–9 : 14–16.
The production of new varieties of plants in the U.S.S.R. and their desirable features are broadly considered, as well as the agricultural and economic evaluation of such new types with a view to their ultimate regional distribution after the official variety tests.

1436. 575:633(47)
T.A.S.S. 63.00.15(47)
(**The net of state breeding stations is approved**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : p. 50.
A list is given of the places at which the stations constituting the new net of breeding stations are established.

1437. KALÉ, G. T. 575:633(54)
The present status of agricultural research in India.
Int. Rev. Agric. 1938 : **29** : T133–47.
Based on Sir John Russell's report on the work of the Imperial Council of Agricultural Research, this account includes a section on plant-breeding work in India on crops other than cotton.

1438. 575:633(82)
Sección genética de granos. (**Grain genetics section**).
"Granos" Semilla Selecta, B. Aires 1937 : No. 1 : 4–5.
A brief outline is given of the programme of work on the genetics and breeding of maize, linseed and wheat of the newly established Division of Grain Production of the Argentine Ministry of Agriculture.

1439. JEBRAK, A. R. 575:633:061.3(47)
(**Some results of IV Session of the Lenin Academy of Agricultural Sciences**).
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 671–702.
In referring to Lysenko's address it is pointed out that Johannsen did not deny the action of natural selection but showed in which types of population it could be effective and in which not; by appropriate citations Lysenko is shown to have misrepresented Johannsen. The degeneration of self-pollinated lines is shown to be susceptible of other explanations than those offered by Lysenko and his data supporting the advantage of intraracial crossing are not yet convincing. No geneticist maintains that all the plants in a field of any variety are identical. Dolgušin's method does not ensure cross-pollination and moreover causes great risk of admixture. Inbreeding has led to valuable results in some crops, not in others and its use depends on circumstances. The acquisition of greater cold resistance after cold treatment is susceptible of a genetical explanation and Lysenko's interpretation is Lamarckistic. The genetical nature of a plant can alter in response to change of environment, but only by natural selection over a long period of years. Lysenko has made important contributions to Soviet science in the theory of phasic development, vernalization, and in his

sincere efforts to translate theory into practice in the service of the growers, e.g. his greatly accelerated methods of plant breeding.
The stages of selection from local populations, introduction of varieties from abroad, and hybridization can and should go on concurrently, not in successive stages as indicated by Vavilov in his address. Most of the controversial issues were moreover avoided by Vavilov. His law of homologous series is in many ways less scientific than Darwin's, who used parallel variation as a proof of common origin. Furthermore, Vavilov's view of the origin of the dominance gradient from the centres of diversity rests on the old presence and absence theory. Vavilov's great contribution is not his law of homologous series, but his accumulation of a vast amount of new material which fits in admirably with the earlier law of analogous variation formulated by Darwin.
The exclusion by Muller of any possibility of the gene being influenced by the surrounding protoplasm is thought to be going too far, especially if one considers the centuries of evolution rather than a few years of experiment.

1440. 575:633:551.566.3(47)
633:0014(47)
M.,V. 63.0015(47)
(Polar Station of the All-Union Institute of Plant Industry—and its work).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 20–25.
A popular outline of the work which has been done by the Polar Station in producing cereals, potatoes, root crops, vegetables and fruits, suitable for the cold northern regions of the U.S.S.R.

1441. 575:633:576.16
Sinskaya, E. N. 581.5:575
(New tendencies in plant breeding).
Vsesojuznaja Akademija Sel'skokhozjaistvennykh Nauk im. V.I. Lenina (Lenin Academy of Agricultural Sciences) Leningrad 1937 : Pp. 56.
Ecotypes, though representing mixed populations rather than pure strains, are nevertheless very definite and fixed in character and show a characteristic reaction to a given set of environmental conditions. They are pure in respect of the group of characters on which the particular environment exerts an influence. Ecotypes which under certain conditions appear similar, under other conditions often prove quite distinct. The ecotype is regarded as one of the stages in the evolution of the species. In the northern, eastern and western ecotypes of vetch all seed coat types were present but in one ecotype the one seed type gave the best yield and in another ecotype a different seed type; thus selection according to seed type will be successful only if carried out on a pure ecotype but not if practised on a mixture of them. These variants within the ecotype are referred to as eco-elements.
The character of a variety produced by breeding depends on the nature of the ecotype chosen as initial material; it is influenced also, however, by the ecological conditions of the region in which breeding is carried on, a region with severe climate, especially one with extremes of climate, tends to produce varieties of a "universal" type. On the other hand on growing an apparently uniform population under unusually favourable conditions atypical forms may often be revealed, as in the case of tau-saghyz, which when grown under irrigation produces about 10 per cent of plants without rest period; these are more vigorous, earlier, and contain a greater percentage of rubber and are thus of great practical value. Growing a strain under favourable conditions also serves to distinguish between the hereditarily and modificationally adapted forms. The converse often holds, namely that hereditary differences of a biological nature may be revealed only under severe conditions of some kind.
One of the main values of inbreeding is in fixing the extreme degrees of a graded series. The various other purposes for which inbreeding is applied are discussed and are shown mostly to have led to negative results. Selection of some such complex adapted system as the ecotype is more effective than the old method of pure line selection. The greater permanence

of varieties of cross-fertilized plants referred to by Lysenko is thought to be the result of the greater plasticity associated with mixed populations, with the consequent capacity to adapt themselves to changes in environment. Changes in the population may, however, be accompanied by an alteration of the agronomic characters too, which may be undesirable, and the position is not as simple as it would appear from Lysenko's writings. The extension of the principle to self-pollinated plants by means of intra-racial crossing would appear to the authoress to have distinct possibilities. Evidence is presented which indicates that heterozygous forms do possess a greater degree of adaptability; old aboriginal forms tend to be more "universal" than the newer forms that have evolved from them; it is thought that the production of spring wheat from winter wheat by Lysenko may represent some similar process, the less plastic homozygotes of an exclusively spring type having been selected. Cyclic crossing between all possible parental pairs of ecotypes is to be preferred to the older method of choosing parental pairs according to individual characters; also crossing between widely differing ecotypes for the production of new types of stable population. In all cases selection should be made for a given type (ecotype, eco-element or group of characters, i.e. viewing the plant as a whole), rather than for single characters; these can become the object of selection only in crops like the cereals where centuries of breeding have gone before and even here ecotype selection is destined to play an extremely important role in breeding for physiological characters.

1442. Totmakov, G. 575:635(47)
(Breeding work with vegetables).
Plodoovoščnoe Khozjaistvo (Fruit and Vegetable Growing) 1938 : No. 1 : 14–18.

Reference is made to improved strains of cabbage, beet, peas, tomatoes and other vegetables produced and various defects in the present system of vegetable breeding in the Soviet Union are pointed out. Extensive use is being made of heterosis in vegetable growing.

GENETICS 575.1

1443. 575·1
Brieger, F. G. 576.312
Genetica moderna—pesquiza e ensino. **(Modern genetics—research and teaching).**
Rev. Soc. Rur. Brasil. 1938 : **18** : 44–48.

The author gives an outline of the department of cytology and genetics at the "Luiz de Queiroz" high school, São Paulo, of which he is in charge, together with a simple explanation of genetical theory. In illustration of the practical application of this he refers to his production by hybridization of strains of maize capable of ripening in the cool climates of England and Germany. Great improvement in maize in Brazil could be brought about if use were made of the best new strains from the U.S.A. on the one hand and the indigenous forms on the other. Reference is also made to the origin of improved bud sports in Brazilian oranges.

1444. Kushner, H. F. 575.1
(Some disputable questions and misconceptions in genetics).
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 703–18.

The author points out, *inter alia*, that the concept of dominance is recognized by the geneticists as being relative and dependent upon conditions of development. The production of earlier F_1 plants by Lysenko's phasic crossing is also not in contradiction with genetical principles; whether or not the later generations will contain still earlier forms depends on whether the phasic type is or is not fully dominant. A number of well established observations are cited by which current genetical theory is confirmed whilst Lysenko's theories are incapable of furnishing a satisfactory explanation.
The method of intraracial crossing is thought to have distinct possibilities, if applied with due regard to genetical principles. Lastly an enumeration is made of a number of lines along which modern genetical investigation has supplemented, in many cases confirmed, in others modified, Darwinian theory.

1445. MÜNTZING, A. 575·1
Genetics in relation to general biology.
Hereditas, Lund 1938 : **24** : 492–504.
Genetics in relation to taxonomy, physiology and human affairs is discussed.

1446. LUS, J. J.,
LIEPIN, T. K.,
SAPEHIN, A. A.,
KOSTOFF, D. and MULLER, H. J. 575.1(47)
(Main results of investigations made in the Institute of Genetics of the Academy of Sciences of the U.S.S.R.).
Bull. Acad. Sci. U.R.S.S. 1937 : 1469–92.
Reference is made to the achievements of the Institute in breeding and genetics in animals and plants. Studies of the inheritance of quantitative characters have revealed over 20 pairs of genes governing ear form in wheat, similar in effect but differing in degree. Extensive pleiotropic effects have also been observed, the gene for glume length in *Triticum polonicum* influencing 16 other characters of the glume, grain and ear. The phenomenon of "shift" has been shown to be the result of polymery.
In crosses of *T. durum* x *T. vulgare* a greater number of *durum* than *vulgare* segregates were obtained and deviations from the mendelian ratios were observed, these being different in the *durum* and *vulgare* groups (Cf. Abst. 1490). Certain forms superior in agronomic value both to the parents and to the local standards have been isolated from this cross.
Crossing capacity in interspecific crosses is found to be influenced by length of style and thickness of pollen tube, also low chromosome number in the pollen parent is advantageous. Large numbers of interspecific hybrids have been obtained in tobacco, wheat and rye, including a trigeneric hybrid of *Triticum*, *Secale* and *Haynaldia*, and a quadrispecific hybrid of *Nicotiana* which, since three of the parental species were allotetraploids, contains the genoms of seven different species.
Certain sterile and partially fertile hybrids have been made fertile by chromosome duplication; for this a variety of methods were used, such as back-crossing with the parent species and utilization of unreduced gametes, if necessary repeatedly, centrifuging etc. Sterile hybrids have also been made fertile by crossing with a third species and in this way trispecific *Nicotiana* hybrids free from nicotine, others with very large leaves etc. have been produced, all giving perfectly fertile offspring with *N. Tabacum*.
A fertile hybrid *T. Timopheevi* x *T. monococcum* has now been produced by chromosome duplication in the sterile hybrid; it contains 42 chromosomes and is exceedingly resistant to fungus and insect attack. Some of the other complex *Triticum* hybrids are also being used in breeding for disease resistance.
The likelihood of getting factorial interchange in wide crosses can be estimated by the amount of chiasma formation; thus the chances are high in crosses of rye with the vigorous wild species *S. ancestrale*, low in crosses of wheat with *Haynaldia*.
X-ray studies have shown the effect to be greater at low than at high temperature. The effect of genes has been found to be mutually altered when they are in juxtaposition; this has been found to be the cause of certain changes hitherto regarded as gene mutations and the question arises as to whether all supposed gene mutations arising from irradiation are not really the effect of translocations too small to be detected.
New methods of examination have led to the conclusion that the gene is of the size of a large protein molecule and that more than one may be present in each chromomere.

1447. 575.113.4
CÂMARA, A. de Souza da 575.113.5
Considerações sôbre a doutrina dos factores modificadores. **(Considerations on the doctrine of modifying factors).**
An. Inst. Sup. Agron. Lisboa 1937 : **8** : 51–62.
The hypotheses of cumulative factors and transgressive segregation are shown to be inadequate to explain many results obtained in crosses. The author is of the opinion that any

quantitative character is influenced by a number of factors, genetic as well as environmental, besides the basal genes that principally determine it.

1448. 575.12
Briggs, F. N. 633.11–2–1.521.6:575.12(79.4)
The use of the back-cross in crop improvement.
Amer. Nat. 1938 : **72** : 285–92.

The exactness and certainty of the back-cross method of transferring characters is emphasized and illustrated. This method has been extensively applied in the wheat-breeding work in California. Resistance to bunt (*Tilletia tritici*) has been transferred from Martin to Pacific Bluestem, Big Club and Sonora and the resistant varieties were released in 1937 under the names Pacific Bluestem 37, Big Club 37 and Sonora 37. This project was started in 1922 and six back-crosses were made in each case. In 1930 the transference of the Martin factor for bunt resistance to seven other varieties was begun and the resistant varieties will be ready for release in 1942.

The incorporation of the stem rust resistance of Hope in White Federation and Baart was also begun in 1930 and the resistant varieties will be released in 1939. Bunt resistant strains of White Federation and Baart were used in the last back-cross, thus combining resistance to the two diseases.

In another project the bunt resistance of Martin, the rust resistance of Hope and the Hessian fly resistance of Dawson are being transferred to Big Club and Poso.

In barley, resistance to mildew (*Erysiphe graminis*) and the awnless, hooded and naked characters are being transferred to Atlas barley. Though difficulties caused by linkage might be expected in view of the low chromosome number of barley (n = 7), no apparent difficulties have so far been encountered. A long-haired rachilla is being transferred to Atlas to enable its grain to be distinguished in the threshed sample.

The back-cross method is also being applied to beans, cowpeas and inbred lines of maize. The value of strains produced by this method for certain theoretical studies is mentioned.

1449. Kostov, D. 575.127.2
Dnešní stav výzkumů o mezidruhovèm křížení. (**Present status of the researches upon the interspecific hybridization**).
Věstn. Csl. Akad. Zeměd. 1938 : **14** : 303–12.

A review of some of the problems involved and the results achieved in interspecific crossing.

1450. 575.17
Brieger, F. G. 633.15:575.116.4.061.6
Alguns aspectos physiologicos da acção dos gens. (**Some physiological aspects of gene action**).
Rodriguésia, Rio de J. 1937 : **3** : 187–98.

The author points out that in reality no character is influenced by one gene alone, even a comparatively simple character such as aleurone colour in maize being affected by four genes and several modifiers. The action of the different genes affecting a character appears to be cumulative. One of the genes *C* governing aleurone colour has an allelomorph C^1 which acts as a colour inhibitor; this is explained on the assumption that the gene in question is one of the extremes of the series, of excessively low value, so that one or even two doses of the higher members are insufficient to bring the individual to the critical value below which the character concerned is not manifested. It seems probable that the action of modifying factors is to alter this critical value, so that a given gene combination will in the presence of one modifier be above the limit, in the presence of others, below. At least three recessive inhibitors and one recessive intensifier have been found in respect of aleurone colour, the latter being located close to brittle (*bt* 1).

1451. GULICK, A. 575.17
What are the genes? II. The physicochemical picture: conclusions.
Quart. Rev. Biol. 1938 : **13** : 140–68.
The author reviews the composition of spermatozoa and nuclei, the number and size of the genes, the enzyme and hormone concepts of gene action, autocatalysis, the chemical picture of a gene and the question whether genes are to be considered as living. The conclusions are summarized and an extensive bibliography is appended.

1452. MULLER, H. J. 575.17:53
The need of physics in the attack on the fundamental problems of genetics.
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 51–58.
Certain physical peculiarities of the genes, such as their power of mutual attraction, autosynthesis, etc., are pointed out for the study of the physicist and attention is called to the resemblance between the gene properties and those of certain viruses that have now been obtained in crystalline form (Cf. also "Plant Breeding Abstracts", Vol. VIII, Abst. 757).

1453. STERN, C. 575.172
During which stage in the nuclear cycle do the genes produce their effects in the cytoplasm?
Amer. Nat. 1938 : **72** : 350–57.
Cases are mentioned in which it can be shown that a gene is able to produce its effect during the resting stage. The possibility is not excluded that there may be cases in which gene-cytoplasm interaction only occurs in the absence of the nuclear membrane.

1454. KRAJEVOJ, S. J. 575.243:576.356:537.5
(**The effect of ultra-short waves on plants**).
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 69–81.
Dry and sprouted seeds of wheat and peas were irradiated with ultra-short electric waves (1–10m) for periods varying from 1 to 15 minutes. No effect on the vegetative period or the yield was observed. The resulting *Pisum* root tips, however, showed various chromosome anomalies such as lagging, formation of micronuclei, chromosome fragmentation, translocation, "somatic reduction" and pseudo-meiotic division, which are described and illustrated. The "somatic reduction", in which 7 apparent bivalents were observed, and pseudo-meiosis, whereby tetrads were formed, resulting in cells with 4 somatic chromosome complements (56), have never been observed under the influence of X-rays.
The possible bearing of these results on the theory of centres of diversity in cultivated plants is discussed, but it is pointed out that not all mountainous areas and zones where high natural radiation would be expected are centres of diversity. The localization of these centres would appear therefore to be the result of their being the sites of ancient agricultural systems. The author is of the opinion that the isolation of deviating forms from the populations occurring in the centres of diversity might constitute a rapid and promising method of producing improved forms of crop plants.

ORIGIN OF SPECIES ETC. 576.16

1455. GATES, R. R. 576.16:575.1:576.3
The species concept in the light of genetics and cytology.
Amer. Nat. 1938 : **72** : 340–49.
A general discussion, being a paper read at the 1938 Indian Science Congress.

1456. PARODI, L. R. 576.16:633
El proceso biológico de la domesticación vegetal. (**The biological process of plant domestication**).
Rev. Argent. Agron. 1938 : **5** : 1–24.
A number of characters are enumerated in which domestic plants tend to differ from wild plants. Various methods of origin of cultivated plants are discussed, such as polyploidy, hybridization, mutation, etc., as a result of which the number of varieties of cultivated plants is enormously increasing.

1457. Freisleben, R. 576.3:575
Cytogenetik und Pflanzenzüchtung. (**Cytogenetics and plant breeding**).
Kühn-Arch. 1938 : **50** : 315–38.
A review of the methods employed and the results obtained in the application of cytology to plant breeding. The production of polyploids, interspecific and intergeneric hybridization and the characteristics of chromosome and genom mutants are discussed in the light of modern researches.
The importance of cytology for plant breeding is no longer doubted and the fact that the results are not too easily obtained should spur workers on to fresh efforts.

1458. Lindegren, C. C. and 576.354.46
Bridges, C. B.
Is agglutination an explanation for the occurrence and for the chromomere-to-chromomere specificity of synapsis ?
Science, 1938 : **87** : 510–11.
It is suggested that the synapsis of specific chromeres is similar to the agglutination of bacteria under the influence of the specific antibodies produced by mammals in immunization.

1459. Câmara, A. de Sousa da 576.356:578.088.2:633.526.2
Estudo preliminar de variações cromosomicas induzidas pela centrifugação. (**Preliminary study of the chromosomal variations induced by centrifuging**).
Rev. Agron. Lisboa 1936 : **24** : 331–47.
Flowers of *Aloë arborescens* were centrifuged for varying lengths of time from 5 to 45 minutes. A study of the pollen mother cells showed various irregularities in the position and form of the nucleolus, and of the chromosomes, unpaired segments, emergence of fragments through the nuclear wall, heteromorphic bivalents and many fragments being observed.
Chromatin bridges were also observed, apparently resulting from minute translocations. This could lead to deficiencies. Anaphase bridges resulting from delayed separation in consequence of the union of the two chromonemata at different loci were also observed. The consequence of this was the formation of fragments of varying size and form.
The effects of centrifuging are seen to be similar, though somewhat less extreme, to those of X-ray irradiation and high temperatures.

1460. 576.356.5:581.04
A tetraploid zinnia.
J. Hered. 1938 : **29** : 187–88.
By dropping dilute colchicine solution on newly emerged seedlings a tetraploid plant has been produced, as indicated by the size of its pollen grains and its larger flower.

1461. Cates, J. S. 576.356.5:581.04
Shuffling the chromosomes.
Ctry Gent. 1938 : **108** : 23, 81.
A popular account of the discovery and importance of colchicine as an agent for inducing chromosome doubling.

1462. 576.356.5:581.04
Dermen, H. 576.356.5:581.036
A cytological analysis of polyploidy induced by colchicine and by extremes of temperature.
J. Hered. 1938 : **29** : 211–29.
Chromosome doubling, in some cases as many as four times, was observed in the stamen hairs of *Rhoeo discolor* as a result of colchicine treatment of the flower buds. Doubling was also observed in the sporogenous cells, both before and during meiosis, but the nuclear divisions

of the pollen grains were apparently not directly affected. The morphological changes produced by applying colchicine to the flower buds are also described and some suggestions for the use of the drug in inducing polyploidy are given. The production of polyploid plants of *Fragaria vesca* by colchicine treatment of young seedlings is mentioned.
Structural as well as numerical changes were induced by temperature treatment.

1463. NAVASHIN, M. 576.356.5:581.04
Influence of acenaphthene on the division of cells and nuclei.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 193–96.

KOSTOFF, D.
Irregularities in the mitosis and polyploidy induced by colchicine and acenaphthene.
Ibid. 1938 : **19** : 197–99.

KOSTOFF, D.
Studies on polyploid plants. Irregularities in the mitosis and polyploidy induced by colchicine and acenaphthene.
Curr. Sci. 1938 : **6** : 549–52.

Both authors report that the morphological and cytological effects of acenaphthene on seeds are similar to those of colchicine, including the production of polyploid cells, the acenaphthene being applied as a saturated solution with excess of crystals by Kostoff and as crystals on wet filter paper by Navashin. It is claimed that acenaphthene will be a more convenient agency for inducing polyploidy than colchicine, being more readily available and less poisonous.
Under the action of either of these two drugs no regular metaphase plate or spindle is formed at mitosis and the chromosomes divide but fail to separate.
Navashin also observed that in cells of *Crepis capillaris* which had become octoploid under the influence of acenaphthene, irregular cell wall formation occurred, cutting off varying numbers of chromosomes. Some of the cells thus cut off had no nuclei whatever. It is pointed out that this phenomenon should allow somatic segregation and the production of haploids and a haploid sector was in fact found in one of the seedlings raised from acenaphthene-treated seed.

1464. SCHMUCK, A. 576.356.5:581.04
The chemical nature of substances inducing polyploidy in plants.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 189–92.

It is pointed out that colchicine is a phenanthrene derivative and moreover differs from most alkaloids in having no heterocyclic ring. It is thus related to the carcinogenic hydrocarbons and sex hormones and it is possible that its biological activity is due to its being a condensed polycyclic hydrocarbon.
The effect of different hydrocarbons on germinating wheat seeds was tested and the substance acenaphthene, a derivative of naphthaline was found to produce morphological changes similar to those produced by colchicine.
Acenaphthene has distinct advantages over colchicine as an agent for inducing polyploidy (Cf. Abst. 1463) notably its less toxic nature and greater ease of production. Though its solubility in water is low (0·003 grm. in 100 ccs.) its action on plants is potent.

1465. ZHURBIN, A. I. 576.356.5:581.49:575–181.12
Comparative study of cell sizes of auto- and allopolyploids.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 467–70.

Data are given on the length and breadth of stomata in diploid, triploid and tetraploid *Nicotiana glauca*, in the amphidiploids *N. multivalvis* x *N. suaveolens* and *Secale montanum* x *Triticum durum* and in the parents of these two hybrids.
The increase in cell size in the *Nicotiana* amphidiploid (as compared with the mean of the parents) was about the same as the increase in the tetraploid *N. glauca* over the diploid. The increase in the *Secale-Triticum* amphidiploid, as compared with its parents, was somewhat greater.

BOTANY 58

1466. Stout, A. B. 581.162.5:575.11
The genetics of incompatibilities in homomorphic flowering plants.
Bot. Rev. 1938 : **4** : 275–369.
A comprehensive review of the literature on the genetics of self-incompatibility and related phenomena.

1467. Crocker, W. 581.48:575.243:581.01
Life-span of seeds.
Bot. Rev. 1938 : **4** : 235–74.
The author finds in chromosome mutations produced by aging the cause of degeneration of old seeds.

1468. Müntzing, A. 581.481:576.356.5
Polyploidy from twin seedlings.
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 211–27.

Müntzing, A.
Note on heteroploid twin plants from eleven genera.
Hereditas, Lund 1938 : **24** : 487–91.
Twin plants have been raised in the following genera:—*Triticum, Secale, Avena, Hordeum, Phleum, Dactylis, Festuca, Lolium, Agrostis, Cynosurus, Poa, Trifolium* and *Solanum.* In all 2201 twin plants have been examined and 77 triploids, 11 haploids, 4 tetraploids and 5 other aberrant forms have been discovered.
The value of this method for obtaining heteroploid forms is stressed and in the first paper an hypothesis of the origin of such twins is advanced. The majority of the twin plants are identical, and presumably monozygotic twins.

AGRICULTURE 63

1469. 63.00.15(82)
575:633(82)
Actividades de las estaciones experimentales. (**Activities of the experiment stations**).
"Granos" Semilla Selecta, B. Aires 1937 : No. 1 : 16–27.
A report is given on the work of the various agricultural experimental stations in Argentina, which has included the production of improved varieties of wheat, maize and linseed.

1470. 63.00.15(89)
Boerger, A. 575:633(89)
Síntesis retrospectiva de la fitotécnia Uruguaya. (**Retrospective synthesis of Uruguayan phytotechnics**).
Arch. Fitotécn. Uruguay 1937 : **2** : 287–391.
An account is given of the organization and work of the research institute, "La Estanzuela", and of the achievements. Reference is made to the production of wheat varieties of improved yield, quality and resistance to *Puccinia glumarum* (Cf. Absts 1486 and 1487). An oat variety 64s with improved yield and good grain of low husk percentage has been produced; also a selection of *Avena byzantina* suitable for grazing; a hybrid between *A. sativa* and *A. byzantina* and a hybrid 64s x 64t are proving promising for the production of rolled oats. A yellow dent corn adapted to the local environment has finally been selected and inbred lines suitable for crossing have been isolated.
Improved forms of barley, both forage and malting types, and of flax have been selected and selection work has also been carried on with soya beans, sunflower and a number of other plants; valuable varietal collections have been made of wheat, lucerne, *Vicia* and other crops and studies have been made of the local grass species.

FIELD TESTS 631.421

1471. KEMP, W. B. 631.421:519.241

Separating a generalized interaction into components.

J. Amer. Soc. Agron. 1938 : **30** : 419–24.

The author gives an example of yield data with duplicate plots of four varieties extending over 15 years. After showing that the variety response is not significant when compared with the variety season interaction, he proceeds to show how the variety differences, and equally the interaction, may be decomposed to test for homogeneity. The conclusion is reached that one variety contributes very markedly to the interaction, and that when this is allowed for, the differences between the others are seen to persist generally, and not to be dependent on season. J. W.

AGRICULTURAL OPERATIONS 631.5

1472. JAKUŠKIN, I. V. 631.521.5(47)

(Some duties in seed raising and breeding).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos. 8–9 : 19–20.

Under the current five-year plan in the U.S.S.R. more attention must be given to seed selection and varietal purity of various grain crops and to disease resistance in cereals and lucerne.

PLANT DISEASES 632

1473. KOSTOFF, D. 632–1.521.6:575.127

(Inheritance of natural immunity in plants and the production of immune varieties by interspecific hybridization).

Problemy Immuniteta Kul'turnykh Rastenii (Problems of Immunity of Cultivated Plants) 1936 : 22–41.

In discussing the inheritance of disease resistance reference is made to the frequency of multiple factors and the consequent possibility of transgressive segregation. It frequently happens that one single gene is responsible for immunity to a large number of physiological forms of a particular fungus. Species such as *Triticum Timopheevi* possessing "group immunity" to a number of different fungi, are especially useful as parents. To utilize such group immunity however the species in question must give hybrids of at least partial fertility in crosses; an example of such crosses is *T. durum* x *T. vulgare*, whose use in producing resistant varieties is illustrated. Recently it has been found possible also to use *T. monococcum*, e.g. by crossing it first with *T. dicoccum* as a bridging cross, or by artificial duplication of its chromosomes before crossing. In the first case a partially fertile *monococcum* x *dicoccum* hybrid is obtained, which when crossed with *T. vulgare* gives hybrids that, although self-sterile, form a few grains when pollinated with *T. vulgare*, with the production of hexaploids containing 1 *monococcum* genom (7) 2 *dicoccum* genoms (14) and 3 *vulgare* (21), as a result of chromosome duplication in the hybrid. Certain irregular numbers, and fragments resulting from crossing-over between *monococcum* and *dicoccum* chromosomes in their homologous sections, occasionally occur. Some of the *monococcum* chromosomes cross over also with some *vulgare* chromosomes and in this way gene transference is possible. Fertile offspring can be obtained from such tri-specific hybrids either by selfing or by crossing with *T. vulgare* and usually contain 42 chromosomes, sometimes slightly more or slightly less.

Another fertile combination was obtained by pollinating *T. vulgare* with *T. monococcum* in 1931; the hybrid produced had 35 chromosomes, evidently being formed from an unreduced *monococcum* pollen grain. The F_2 plants varied from 30 to 33 in chromosome number and were of differing degrees of fertility, the majority being highly fertile. Certain *compactum* types appeared. The variation in type was still higher in the F_3, the segregates including certain fully fertile intermediate forms with 28 and 29 chromosomes, a few forms closely resembling *T. monococcum*, and some new types not resembling either of the parental species. Many of these forms crossed readily with *Triticum* species and all those possessed of immunity can be employed therefore in breeding for disease resistance. The fertile 28 chromosome forms obviously contain one full genom of each species and are immune only in respect of immunity genes that are dominant.

T. Timopheevi is difficult to cross with the other species, even those of the same chromosome number, but hybrids have been obtained with *T. durum*, *T. vulgare* and even with *Aegilops*, *Secale* and *Haynaldia*.
All hybrids are self-sterile, but partially fertile with the parental or other species. One of the *T. Timopheevi* genoms never conjugates fully with any genom of other species and seems to be quite distinct; if this is the genom that bears the immunity genes their transference to other species may be impossible, though some of the amphidiploids may be of practical interest.
Of the hybrids with other genera the rye hybrids appear to be the most promising; cytological evidence suggests that crossing-over occurs between certain sections of the *Triticum* and *Secale* chromosomes, which makes gene interchange possible, though extremely rarely.
The use of interspecific crossing in breeding for resistance in vegetatively reproduced plants is illustrated by reference to sugar cane.

1474. Vavilov, N. I. 632–1.521.6:581.9
(System in the distribution of immunity to infectious diseases).
Problemy Immuniteta Kul'turnykh Rastenii (Problems of Immunity of Cultivated Plants) 1936 : 5–16.

The importance of the degree of specialization both of the fungus and of the host species in relation to breeding for immunity is emphasized. This is illustrated by reference to the wheats, where the different groups, characterized by differences in geographical distribution, chromosome number and a series of other features, display marked differences also in reaction to disease; the group centred in Transcaucasia and the Mediterranean contains the greatest proportion of resistance genes. Again in oats, immunity seems to be concentrated in the Mediterranean group (*A. byzantina* and *A. sterilis*) and these species have been successfully used for crossing on this account in the U.S.S.R.; some of the Pyrenean species (*A. brevis* and *A. strigosa*) are also immune to smut and rust. The Mediterranean forms of flax are also characterized by disease resistance; in potatoes the greatest immunity occurs in southern Mexico, in pears in eastern Asia, and so on. The localization of resistance in this way is clearly the result of the evolution of the species and the genetical groups within the species. The practical importance of the principle lies in the fact that many of the forms from these centres of immunity exhibit resistance to all existing physiological forms of a given fungus or to whole groups of them, and even to whole groups of fungus species, which gives a very important new line to the plant breeder.

1475. Semakin, K. S. 632.112–1.521.6:578.081
(Growth as indicator of drought resistance).
Acta Inst. Bot. Acad. Sci. U.S.S.R. 1938 : Ser. IV : 241–77.

Experiments are described which show that in the first growth phase, that of cell division, drought-resistant varieties have a lower water content than susceptible varieties. Resistant varieties have a higher water absorbing capacity, both from solutions and vapour, and their cells can therefore in the subsequent stage distend at a lower humidity than susceptible varieties. A method of determining drought resistance is proposed consisting in the measurement of the rate of growth of seeds under conditions of limited water supply. Tests of wheat varieties of known resistance, including Graecum 0289 and Erythrospermum 0841 as resistant varieties, Erythrospermum 0341 as medium and Marquis and Novinka as susceptible, have proved the reliability of the method.

1476. Holton, C. S. 632.451.3:575.127.2:576.16:633.11
A new pathogenically distinct race derived from a cross between *Tilletia tritici* and *T. levis*.
Phytopathology 1938 : **28** : 371–72. (Abst.)

F_2 chlamydospores from a cross between race T–9 of *Tilletia tritici* and race L–8 of *T. levis* were used to inoculate the wheat varieties Hybrid 128, Oro and Hohenheimer. The hybrid race attacked all three varieties whereas no previously known race of either *T. levis* or *T. tritici* has been able to attack both Oro and Hohenheimer. Race T–9 attacks Hohenheimer and L–8 Oro.

1477. Straib, W. 632.452 *P. glumarum*:576.16(8)
Las razas fisiológicas de *Puccinia glumarum* en Sudamerica y su comportamiento en la infección comparado con el de las formas Europeas. (**Physiological races of *Puccinia glumarum* in South America and their infective behaviour compared with European forms**).
Arch. Fitotécn. Uruguay 1937 : **2** : 217–33.
An examination of the South American races of this fungus suggests that progressive mutation has been an important factor in their origin. The reaction of different varieties to the particular forms present is tabulated and indications are given as to the most suitable for use as parents in breeding for resistance.

1478. Giddings, N. J. 632.8:576.16:633.63
Studies of selected strains of curly top virus.
J. Agric. Res. 1938 : **56** : 883–94.
It is shown that there exist strains of the curly top virus with different abilities to infect and injure different hosts.

ECONOMIC PLANTS 633

1479. 633:575.42:575.12:578.08
Bolsunov, I. I. 633.71:575.125
(**Selection of hybrid combinations in breeding on the basis of a high yielding F_1**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos. 8–9 : 23–24.
The breeder desiring high yielding hybrids superior to the parents should select combinations in the F_1 that show heterosis, the occurrence and utilization of which phenomenon are considered with the findings of other workers such as Jones and East. Experiments with various ecotypes of *Nicotiana rustica* aiming at the production of hybrids which more or less retained the luxuriance of the F_1 are described and a programme is outlined for breeders wishing to apply the method of selection on the basis of the F_1 yield.

CEREALS 633.1

1480. Syrovatskii, S. G. 633.1–2.452–1.521.6
(**Rust resistant varieties of wheat, barley and oats**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 17–19.
Promising hybrids obtained by crossing a number of the American resistant varieties with Ukrainka and other local forms are described.

WHEAT 633.11

1481. 633.11:575(48.5)
Åkerman, Å. 633.11 Diamant II
Svalöfs Diamantvårvete II. Ny sort av Diamanttyp men högre avkastande och stråstyvare samt med bättre bakningsförmåga. (**Svalöfs Diamant spring wheat II. A new sort of the Diamant type but higher yielding and stiffer strawed with better baking quality**).
Sverig. Utsädesfören. Tidskr. 1937 : **47** : 439–49.
Diamant II, from the cross Extra-Kolben II x Diamant, is as early as Diamant, higher yielding, of good standing capacity, resistant to yellow rust and in baking quality it is a definite improvement on Diamant I.

1482. Boeuf, F. and
Séguéla, J. 633.11:575(61.1)
L'amélioration du blé dur (*Triticum durum* Desf.) au Service Botanique et Agronomique de Tunisie. [**The improvement of hard wheat (*T. durum* Desf.) by the Botanical and Agronomical Department of Tunisia**.
Sélectionneur 1937 : **6** : 121–36.

The local varieties are first briefly described. From these some strains have been selected that are higher yielding, more resistant to disease and of good quality. Selections are also noted from varieties introduced from other parts of North Africa.
An extensive programme has been designed including *vulgare* wheats, *Secale*, *Aegilops* and *Agropyrum*.
Some of the results of inter- and intraspecific crosses are briefly recorded. The improvement of quality is of special importance.

1483. Miège, E. 633.11:575(61·1)
Aperçu sur les blés durs marocains et leur amélioration. (**Brief account of the hard wheats of Morocco and their improvement**).
Sélectionneur 1937 : **6** : 137–56.

The importance of hard wheat in the agricultural programme of Morocco and its distribution are noted. The types cultivated are briefly described, including the products of selection. Hybridization includes intra- and interspecific crosses as well as intergeneric crosses with *Aegilops*.
The methods for the multiplication and distribution of the grain of the hard wheats are described and the value of their flour for industrial purposes is estimated.
Notes are also given on some botanical studies in progress on the wheat plant.

1484. Worzella, W. W. and
Cutler, G. H. 633.11:575(77·2)
Character analysis of winter wheat varieties.
J. Amer. Soc. Agron. 1938 : **30** : 430–33.

Data are given for 30 varieties of soft and semi-hard winter wheat grown at Lafayette, Indiana on 11 characters, concerning winter-hardiness, yield, quality, disease, height of plant and strength of straw.

1485. Rudorf, W. and
Rosenstiel, Kl. von 633.11:575(82)
Reminiscencias de nuestros trabajos de selección triguera en el Río de la Plata. (**Reminiscence of our plant breeding work in the River Plate regions**).
Arch. Fitotécn. Uruguay 1937 : **2** : 392–401.

In nearly all crosses with Lin Calel the high gluten quality of this variety was transmitted to the progeny; in the cross with Chinese 166 only the winter segregates were of first quality, and only the spring segregates in the cross with Gros Bleu. There appeared in nearly all crosses forms displaying resistance to all forms of *Puccinia glumarum* at high temperatures, though forms resistant at temperatures below 11° C were much less common, occurring only in the crosses Chinese 166 x Lin Calel, Chinese 166 x 38 M.A., Chinese 166 x Chinese 466, Mentana x M.A., H.51 x Mentana and Riccio x Lin Calel. Resistance to certain physiological forms occurred in some of the other crosses.
Resistance to four forms of *P. triticina* occurred in the crosses Peragis x 38 M.A., Heines Kolben x 38 M.A., Mentana x 38 M.A., 12 H_3 x 38 M.A., H.51 x Mentana, Ardito x Lin Calel and Riccio x Lin Calel. Thus the crosses with 38 M.A., Ardito and Riccio are the best as regards resistance. Mildew resistance appeared only in two crosses, Normandie x 38 M.A. and 12 H_3 x 38 M.A. Moreover, all the hybrids with Lin Calel displayed a certain amount of

frost resistance and since these wheats have no winter rest period their resistance must be of a different type from that of the common winter varieties, and they may be of value in breeding.
These results show the crosses in question to be of interest not only in Argentina but for wheat breeding in Germany and other parts of the world.

1486. 633.11:575(89)
BOERGER, A. 633.11(89)
Orientación en la selección triguera de La Estanzuela. (**Bearings in the wheat selection of "La Estanzuela"**).
Arch. Fitotécn. Uruguay 1937 : 2 : 1–84.

Experience soon showed the local wheats, adapted as a result of natural selection, to be the best breeding material, as instanced by Pelón 33c, one of the first pedigree selections, which almost immediately replaced all earlier wheats both in Uruguay and in the Argentine. It proved inferior in gluten quality however. Another pedigree variety, Americano 44d, though lower in yield, was much higher in gluten quality, though of low diastatic power, and a mixture of the two gave excellent flour.
The hybrid variety Artigas, being the progeny of a cross of two pedigree selections of the "Americano" (awned) type, still further raised the yielding capacity. It is also a variety of greater plasticity, suffering less from unfavourable conditions of growth, late sowing, etc. In quality it is also superior but succumbs to *Puccinia glumarum*.
A cross of Pelón 33c with Americano 25e yielded another excellent variety, Larrañaga; in yield it is equal to Artigas, it reacts well to late sowing, which actually improves the grain quality, it is more resistant to *P. glumarum* and of superior baking quality, some other segregates from the same cross displayed still greater rust resistance. Certain awnless segregates also occurred and have given rise to the variety Pelón IVy, somewhat resembling Pelón 33c in type, highly tolerant of unfavourable conditions and much more rust resistant; it was low in quality, however, and has since been discarded. From the cross Americano 44d x Pelón 33c an excellent variety named Acd 11, was produced; it is of superior quality, rust resistant and unusually plastic, and has outstripped even Larrañaga in yield.
Crosses of Artigas x Larrañaga were made with the object of producing rust resistant wheats; the variety Centenario was produced in this way, possessing satisfactory resistance to *P. glumarum* and *P. triticina*, quality distinctly superior to Larrañaga, strong straw and various other good features. The variety Renacimiento arose from a natural hybrid from the variety Americano 25c; like Porvenir, from the cross between line 26n and hybrid IVl (33c x 25n), it is resistant to *P. glumarum* and *P. triticina* and of good quality, though inferior to Centenario. The varieties Renacimiento and Porvenir react usually well to delayed sowing and are altogether very plastic.
For improving the quality of Pelón 33c it has been crossed with the Argentine variety 38 MA, giving rise to the series of varieties of the name Litoral. These are high in yield, possessed of suitable plasticity as regards time of sowing etc., resistance to *P. glumarum*, *P. triticina*, and also *Ustilago tritici* and are better than all the others in baking quality. Another wheat of high quality is 1931d, a selection from Klein 31, which is a hybrid between one of the segregates from the cross that gave rise to Larrañaga and Ardito; also a selection 2762, from Klein's cross of Vencedor (Americano 44d x Barletta) and Ardito.
An examination of the problem of quality leads to the conclusion that strength can be overestimated and that it is more advantageous to produce grain of good "equilibrium," capable of yielding a flour that can be used directly for the production of good bread without mixing with other varieties. Flavour is a point that has received insufficient attention. Tests of the fermentation time in a number of samples of each of the wheats described above showed considerable variation within each variety and a final assessment of the quality of the respective varieties was only possible after the application of other tests including baking tests. There was no correlation between the fermentation time and the protein content. All the new wheats proved superior to Larrañaga and perfectly suitable for direct use. Though they are of the "soft" type, they adequately fulfil the local demand and in view of the recent scarcity of soft wheats are thought promising also for export.

The net result of the use of the new varieties has been a rise of 62 per cent. in the yield per hectare, in addition to a great improvement in quality. As they are all of the same general type there is not thought to be any disadvantage in cultivating several of them as regards uniformity of product, and a great advantage as regards reliability of yield in different years and different areas.

1487. 633.11:575(89)
DELLAZOPPA, J. G. 633.11 Litoral
El trigo Litoral y las nuevas líneas genéticas Litoral 1 y Litoral 2. (**The wheat Litoral and the new selections Litoral 1 and Litoral 2**).
Arch. Fitotécn. Uruguay 1937 : **2** : 107–15.

In 1926 various crosses were made between the Argentine variety 38 M.A. and local varieties produced in Uruguay (Cf. Abst. 1486).
The Argentine variety, a hybrid of Barletta x Chinese, is resistant to *Ustilago tritici* in addition to *Puccinia glumarum*, is early in maturity and of excellent quality for direct use. The cross with Pelón 33c, deficient in quality, gave rise to two F_1 plants, BE_1 and BE_2; from the former an F_3 plant was selected which gave exceptionally high yields and was resistant to *P. glumarum*; these results persisted and in F_6 the strain was named Litoral. From another F_2 plant of the same series another promising line was selected and ultimately named Litoral 1 and a selection from the progeny of the other F_1 plant was named Litoral 2. The characteristics of these three varieties are tabulated. In yield they are equal, giving 22.1–22.3 quintals per hectare, which is about 200 per cent of the standard variety Larrañaga; Litoral is the most resistant to *U. tritici*, Litoral 2 is best in fermentation time and baking value and in 1,000 corn weight.

1488. NIEVES, R. 633.11:575.11
Herencia de algunos caracteres morfológicos y fisiológicos en el trigo. (**Inheritance of some morphological and physiological characteristics of wheat**).
Arch. Fitotécn. Uruguay 1937 : **2** : 413–51.

Florence has the advantage of being very resistant to rust and smut, early and adaptable to late sowing and of yielding exceedingly white flour, all points in which Kanred is deficient; the two varieties were therefore crossed. Florence was also crossed with Barletta to obtain a mid-season variety with coloured grain of the semi-*durum* type resistant to rust and smut. In the first cross the coloured grain of Kanred was dominant in F_1, giving trihybrid ratios in later generations. The awnless character was not absolutely dominant in the F_1 which had glume tips somewhat longer than those of the awnless parent Florence. Sub-aristate forms appeared in the F_2 and F_3, where the figures conformed most closely to a dihybrid segregation, 3 : 9 : 3 : 1. Accurate measurements of the awn lengths however showed that none of the progenies reproduced the exact Kanred type, which has a mean awn length of 90 mm. whilst the segregates fluctuated between 73·4 and 81 mm. The analysis of the results leads to the postulation of two pairs of genes, a major *Aa* and an intensifier *Tt*, with one or more pairs of modifiers, the interaction of which causes fluctuation in the F_1 and prevents the recovery of the parent type in a relatively small F_2; the Kanred type was recovered by growing a large F_4 population. The medium tillering of Florence was dominant to the abundant tillering of Kanred, only one factor pair being apparently involved. Tallness introduced by Kanred, was dominant, two independent genes being suggested. Both parents were of medium density and forms denser than the parents appeared in F_2 in the proportion 9 : 7; each variety appears to be homozygous for one of two independent dominant density genes.
In the Barletta x Florence cross dwarfs appeared in certain of the F_2 families in the ratio 3 : 13, the Barletta parent being apparently impure for this, as for certain other characters; the results suggest the existence of a dominant *N* for tallness which also acts as the inhibitor of *E*. Barletta is thought provisionally to be the double recessive and Florence the double dominant but all dwarf F_2 plants were sterile and the hypothesis could not be checked.
The erect habit of Florence was dominant and monofactorial. The F_1 came into ear on the same date as Florence, the early parent, but in later generations segregation showed earliness to be conditioned by three independent genes.

Using a constant method of artificial infection with race t–5 of *Tilletia tritici*, applied during the cool season of the year, resistance was shown to be recessive in the cross Barletta x Florence, at least two pairs of genes being responsible, with possible modifiers too.
No linkage was observed between any of the characters studied.
The author compares his results with those of previous investigators, whose findings are discussed in detail.

1489. FOURMONT, R. 633.11:575.127.2(44)
Observations sur quelques hybrides de blé en 1re et 2e générations. (**Observations on some F_1 and F_2 wheat hybrids**).
Sélectionneur 1937 : **6** : 178–83.

A number of interspecific crosses were made from which conclusions are drawn as to the dominance and recessiveness of certain characters. In two crosses of awned with unawned varieties the F_2 was studied. The data were not sufficient for an accurate numerical analysis but the figures suggest a monofactorial inheritance with dominance of awnlessness.

1490. *SAPEHIN, A. A. 633.11:575.127.2:575.114
(**Peculiarities of segregation in hybrids between *durum* and *vulgare* wheats**).
Bull. Inst. Genet. U.S.S.R. 1938 : No. 12 : Pp. 66.

In the cross *T. vulgare miltiurum* 00274 x *T. durum melanopus* 00122 monohybrid ratios were observed for awn development, though when the *durum* and *vulgare* groups of segregates were examined separately it was found that the *vulgare* group contained an excess of awned individuals, with a corresponding deficiency of awnless. There was also a deficiency of segregates with obtuse glume tip, with *durum* type of glume shoulder, with solid straw, with excess of those with the *vulgare* type of shoulder, with acute shoulder, and with white ears. The ears in the *vulgare* series were laxer and had a smaller average number of spikelets; the variation in yield of grain per ear was also less. In addition to the deficiencies in these particular classes, there were marked deficiencies of certain combinations of characters, such as awnless pubescent ear, awnless with obtuse glume tip, pubescent with obtuse tip, narrow shoulder with obtuse tip, awnless with narrow shoulder, pubescent with *durum* shoulder, pubescent narrow shoulder, *durum* shoulder and obtuse tip, *durum* shoulder and acute tip, red ear and obtuse tip and red with filiform tip, with corresponding excesses in the other groups. The yield was greater in the awnless segregates in the *vulgare* group and in the awned segregates in the *durum* group; similarly in the obtuse types in the *vulgare* group and the acute in the *durum*; the solid straw forms had a higher yield in the *durum* group but not in the *vulgare*, these differences being all due to a larger number of grains per ear. Moreover the deficiency of red-eared forms was almost confined to the awnless group and entirely confined to the forms with pubescent ear, and the deficiency of *durum* shoulder and narrow shoulder is greater in the red eared group.
Many possible interpretations of these deviations are suggested, the most probable being thought to be that the 7 univalents are not distributed at random to the daughter nuclei at the end of the heterotypic division. It seems clear too that the white ear univalents alter the rate of growth of the pollen in the F_1 styles, usually accelerating it in combinations containing *vulgare* characters and retarding it in combinations with *durum* genes, though the converse occurs at times.
Further studies of a fertile 36 chromosome segregate with $16_{II} + 4_I$ referred to in earlier publications have been made. Segregates up to F_{12} have been examined and mostly contained 36 chromosomes, with occasional deviations. The results of crosses with the parental species showed that nearly all the egg cells had 20 or 19 chromosomes, a few 18, none less. This indicates that megaspores with a larger number of chromosomes are more viable than those with the lesser numbers. The pollen on the other hand contained mainly 16–18, though occasionally 19 and a few 20.

* An extended summary of this paper is on file at the Bureau.

An unexpectedly large number of individuals homozygous or almost so was observed in the F_2 of the cross here described, although the evidence indicates that segregation is occurring for genes in each of the 14 bivalents. The author interprets this by a tendency of the bivalents to separate not at random but to travel together to one pole or the other, though without any physical connexion.
The failure in later generations to obtain individuals of equal vigour with the heterosis plants of F_1 and F_2 the author explains as follows: many physiological factors in small doses have a favourable effect and in larger doses are inhibitive—similarly one gene (as in F_1) may be highly favourable, but double doses occurring in homozygous or partially homozygous segregates in later generations are depressive. The frequent reduction in productivity in polyploids argues in the same direction.
The results of the cross indicate the possibility of producing by this means varieties of agronomic value and two varieties excelling the standard 062 in yield, tolerant of unfavourable soil conditions and resistant to drought, shedding, smut, Hessian fly (in one of the hybrids) have already been produced from it. These hybrids have been shown to possess high milling and baking quality and are now proving their worth in the All-Union varietal tests, under the names Od. 3 and Od. 4.

1491. Almeida, J. R. M. de 633.11:575.127.2:575.114:575.113.5
Um caso de escamoteação num cruzamento "*dicoccum* x *polonicum*". (**A case of "shift" in a cross "*dicoccum* x *polonicum*").**
Rev. Agron., Lisboa 1937 : **25** : 38–55.

Twenty-three F_2 plants of the intermediate type from the cross *Triticum dicoccum* x *T. polonicum* were taken for the production of later generations, in which the dimensions of the glumes, taken as the average of 10 glumes per plant from the centre of the ear, were measured. The glume length of the F_2 plants varied from 12 to 16 mm. The F_3 contained *dicoccum*, *polonicum* and intermediate types in the ratio 1 : 2 : 1 approximately, which the F_4 results confirmed. The glume length varied however in each group, especially in the *polonicum* group; the mean length moreover was 26.50 per cent less in the *polonicum* group than the mean for pure *T. polonicum*, and slightly greater (13·90 per cent) in the *dicoccum* group than that for the pure species.
The F_3 plants were grouped according to the glume length and the progeny of each sown separately. The F_4 plants from each F_3 were measured. In some cases the differences were transmitted to the progeny, in others there were clear signs of segregation for modifying factors. One F_3 plant of the *polonicum* type had glumes longer than the rest and more nearly approaching the *T. polonicum* parent. The F_4 progeny of this plant proved in F_5 to be homozygous and gave glume length measurements equal to pure *T. polonicum*. The ratio of the different types suggested the operation of two pairs of dominant modifying factors in addition to the main gene pair governing the presence or absence of the *polonicum* type of glume, the action of the modifiers being to reduce the length of the glumes. These results, and especially the recovery of the parental type in the F_4, lead the author to conclude that the phenomenon referred to as "shift" is the result of modifying factors.

1492. Yamashita, K. 633.11:575.127.2:581.446.1
(Some genetical characters of the wheat straw).
Agric. & Hort., Japan 1937 : **12** : 2585–93.

In one trisomic line of the back-cross (*T. polonicum* x *T. Spelta*) x *T. polonicum* the uppermost node of the stems of 29-chromosome plants was longer in relation to its width than that of the 28-chromosome plants; the stems of the former were more flexible. In another trisomic line the relationship was reversed.
The inheritance of hollow and solid straw is briefly discussed (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 457).
T. polonicum carried its ears erect, *T. Spelta* obliquely and in a 28-chromosome line from the above back-cross segregation into 3 erect (*E*) : 1 oblique (*e*) was observed.

1493. MATSUMURA, S. 633.11:575.127.5:576.356.4
Zwei unerwartete 36-chromosomige Pflanzen in der Rückkreuzung *T. polonicum* x (*T. polonicum* x *T. Spelta*). [**Two unexpected 36-chromosome plants in the back-cross *T. polonicum* x (*T. polonicum* x *T. spelta*)**].
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 293–98.

Though the back-cross of a pentaploid wheat hybrid to the tetraploid parent would not be expected to give plants with more than 35 chromosomes, two plants, Nos. 28 and 85, with 36 chromosomes were obtained from the above cross. No. 28 showed $1_{III} + 13_{II} + 7_{I}$ in 16 and $14_{II} + 8_{I}$ in 34 pollen mother cells while No. 85 showed $14_{II} + 8_{I}$ in 1, $15_{II} + 6_{I}$ in 46 and $1_{III} + 14_{II} + 5_{I}$ in 3 pollen mother cells. The chromosome numbers in the progeny of No. 28 ranged from 29 to 33 and from 37 to 39, those of No. 85 from 29 to 42. Chromosome fragments were found in some progeny of No. 28.

It is inferred that No. 28 had an extra chromosome of either the A or B genom and No. 85 an extra chromosome of the D genom.

1494. WILLIAMSON, J. 633.11:575.127.5:633.14
Las posibilidades del cruzamiento entre trigo y centeno. (**Possibilities of wheat-rye crosses**).
Arch. Fitotécn. Uruguay 1937 : **2** : 182–88.

An F_5 selection from the progeny of a wheat-rye hybrid being fertile and resistant to *Puccinia*, is being used in crossing with various wheat varieties. The behaviour was typical of crosses between wheat varieties but all the segregates were low in yield and segregation continued up to the tenth and later generations. Here certain selections proved promising in regard to yield, disease resistance and type of grain and selection is being continued.

1495. 633.11:575.127.5:633.289
KHIŽNJAK, V. A. 633.11:575.129
(**Wheat-*Agropyrum* amphidiploids –a new useful fodder crop plant**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 56–57.

Amphidiploids have been produced at the Saratov Breeding Station by selfing certain clones of the F_1 obtained from crosses of *Triticum durum* and *Agropyrum intermedium* and, if grown on a large scale, would, it is believed form an excellent perennial crop for grass or hay while also giving a good yield of small grain suitable for feeding livestock or poultry.

The fertility and set of the F_1 and the amphidiploid forms are described with observations on the luxuriant root system and tillering of the latter plants. The main features for which the amphidiploid is recommended are: the absence of rhizome, the stem and leaf characters, grain yield and probable resistance to drought and cold. Multiplication of the experimental crop can, it is said, be effected by cuttings as well as by seed.

1496. 633.11:575.127.5:633.289
TZITZIN, N. V. 633.11:581.143.26
(**Work on the production of perennial wheat**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 18–20.

This paper is concerned mainly with the problem of frost resistance in perennial wheat x *Agropyrum* hybrids which has been more fully discussed in a previous pamphlet (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 1156). The hybrid wheat No. 34085 is believed to possess the biological basis for resistance to low temperature and is resistant to diseases and to drought. Its suitability for mechanized harvesting, its morphological and other characteristics including its high tillering capacity are discussed with observations on suitable cultural measures to ensure the several harvests which can be obtained from this hybrid.

1497. Câmara, A. de Souza da 633.11:575.242:576.356.2
Notas sobre espeltoides. (**Notes on speltoids**).
Rev. Agron., Lisboa **1936** : **24** : 301–18.

In the cross Almadense (*T. vulgare* var. *lutescens*) x Amarelo de Barba Branca (*T. durum* var. *affine*) certain speltoids with excessively dense ears appeared in the F_2. They had free glumes, and no speltoids occurred in any other crosses of the same *durum* line with other *vulgare* forms, showing that they are not merely the result of the action of the factor for attached glumes present in the *durum* parent.

The most characteristic of these speltoids contained 42 somatic chromosomes but careful examination showed the presence of certain chromosomes of exceptional length and others abnormally short; a heteromorphic bivalent was seen at first metaphase, as well as occasional trivalents. The author is of the opinion therefore that translocation is the primary cause of speltoidy and that the frequent addition or loss of a chromosome is a secondary phenomenon. In support of this he mentions the greater frequency of occurrence of speltoids in northern countries with low temperature conditions than in the countries of the south. It would appear that the chromosome is more sensitive to rupture in the region immediately below the speltoid gene, which would account for the greater frequency of this than of other mutations. The speltoid gene would generally pass without the awnless gene, giving rise to an awned speltoid, except in the case of a long translocation when the awnless gene might also be involved.

1498. Parisot, F. and 633.11:575.42
Girard, E. 633.11 Téverson
Sélection généalogique du blé Téverson. (**Genealogical selection of Téverson wheat**).
Ann. Éc. Agric. Rennes **10** : 45–47.

Téverson wheat, also known by the name of "Goldendrop à épi carré," is a much cultivated variety in the north of Brittany. It is very adaptable to soil and climate and resistant to disease. Selection has been undertaken for a lower and more regular production of tillers so that ripening may be more even.

1499. 633.11:575.7
Câmara, A. de Sousa da 631.524.5:575.41
Conceito actual da degenerescência dos trigos. (**Present conception of the degeneration of wheat**).
Rev. Agron., Lisboa **1937** : **25** : 81–95.

It is pointed out that the apparent degeneration of a high-bred variety, which is often observed by farmers to such an extent that it becomes inferior to the old land races, may often be the result of impovishment of the soil, under which conditions the old strains are better; when the fertility is restored the new varieties often regain their superiority. However, a pure line is, in practice, almost an impossibility; and it seems that plants homozygous for yield factors tend to be less resistant, so that they are most frequently eliminated by natural selection. It is possible that this may constitute a real cause of degeneration. The lack of purity on the other hand provides material for natural selection to produce a race adapted to local conditions and in this respect far from being a disadvantage is a definite asset.

1500. Myers, W. M. and
Powers, L. 633.11:576.356:575.11
Meiotic instability as an inherited character in varieties of *Triticum aestivum*.
J. Agric. Res. **1938** : **56** : 441–52.

The frequency of micronuclei occurring at the pollen tetrad stage was measured in 1931 in the following spring wheat varieties: Marquis, Thatcher, H–44, Double Cross 2305 and Supreme, the average frequencies being 0·9, 0·8, 4·1, 5·5 and 8·3, respectively. Marquis and Thatcher are therefore relatively stable and the other varieties unstable in meiosis. Thatcher, Double Cross and H–44 have interspecific crosses in their ancestry; Marquis is derived from a varietal cross and Supreme is a selection from Red Bobs.

Lines were established from individual plants with low meiotic instability in Thatcher, with low and medium meiotic instability in Marquis and Double Cross and with low, medium and high instability in H–44 and the average percentages of micronuclei in these lines in succeeding years showed that it was possible in this way to select for different degrees of stability. It is therefore concluded that meiotic stability is genotypically controlled.
Analysis of variance showed that certain of the lines of low and medium instability reached homozygosity in 1936, but the highly unstable line of H–44 was still segregating.
A comparison of the percentages of micronuclei in fixations made on different days showed that environment also has a significant effect on meiotic instability.

1501. YAMASHITA, K. 633.11:576.356.5:575.255
Über eine diplo-tetraploide Chimäre bei *Triticum*. (**On a diplo-tetraploid chimaera in *Triticum***).
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 1062–69.
In a 29-chromosome plant from the back-cross (*T. polonicum* x *T. Spelta*) x *T. polonicum* some anther locules contained pollen mother cells with 58 chromosomes while other locules had 29-chromosome cells. Diploid and tetraploid cells never occurred in the same locule. Varying numbers of quadrivalents occurred in the tetraploid pollen mother cells and nuclear migration was observed.

1502. KOSTOFF, D. 633.11:576.356.5:578.08
Studies on polyploid plants. Polyploid forms of *Triticum* experimentally produced. XII.
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1936 : 3–22.
The existing data on allopolyploid and trispecific hybrids obtained in wheat are surveyed. Figures are given on chromosome pairing in the hybrid (*T. dicoccum* × *T. monococcum*) × *T. vulgare*, the hybrid having 42 chromosomes representing the genoms of all three species; 8-10 univalents, 10-14 bivalents, 2-4 trivalents and occasional quadrivalents occurred. Data also are given on pairing in the reduced allopolyploid hybrids containing some but not all genoms of the parent species. The fertility of the allopolyploids varies with growth conditions, the reduced allopolyploids are usually self-fertile. The frequent occurrence of slight chromosome irregularities in the polyploids causes them to be prone to spontaneous variation and the triple 42 chromosome wheat hybrids in succeeding generations produced forms with 40, 41, 43, 44 and even more chromosomes in addition to 42 chromosome plants; fragments of varying sizes were also observed. Similar aberrations were found in the progeny of the reduced *Triticum-Secale* and *T. vulgare-T. monococcum* allopolyploids. The practical advantages of this capacity for variation are pointed out.
The F_1 *T. Timopheevi* × *T. monococcum* has been crossed with a 28 chromosome duroturgidoid segregate from the F_1 of the cross *T. turgidum-dicoccum-vulgare*; one of the resulting plants was morphologically identical with the F_1 but had 42 chromosomes and was fertile, having evidently arisen from an unreduced egg cell. This hybrid is thought to be of practical value in that, having 42 chromosomes, it might be crossed with *T. vulgare* and so introduce the resistance of *T. Timopheevi* into this species. Similarly the triple hybrids with *T. monococcum* may be a means of utilizing the genes of this species in breeding. The reduced allopolyploids are of interest phylogenetically, showing that the genoms of the species like *T. vulgare* remain independent; that of *T. vulgare* / *T. monococcum* is fertile with other species, including *T. persicum*, and may be of some practical interest, since the hybrids have large grains and are resistant to rust and mildew.

1503. 633.11:581.143.26:633.18
YAMASAKI, Y. 581.142:581.3:578.08
(Embryo-transplanting as a method of genetico-physiological investigation in cereal plants).
Proc. Crop Sci. Soc., Japan 1937 : **9** : 382–89.
The writer had previously found that wheat embryos from a variety characterized by dormancy, Norin No. 4, when either restored to their own endosperm or transplanted into grains of the same variety showed a very slight increase in germination, while transplantation into

the endosperm of certain other varieties of wheat or rye increased germination still further. Subsequent work now shows that embryos of Norin No. 4 and Wase-komugi (an early wheat) when transplanted into endosperms of grains of a non-dormant type germinate better than when the transfer is to dormant grains. Moreover Highland rice grains promote the germination of transplanted wheat embryos more than Lowland rice does, and the same relationship holds between the endosperms of non-glutinous and glutinous rice respectively in promoting the germination of wheat embryos.
The application of embryo transplantation in determining the age of either endosperms or embryos is discussed with some experimental data.

1504. Čerenakhin, V. I. 633.11–1.524.4(47)
(Local spring wheats of the White Russian station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 20–21.
An examination of the varieties produced by selection from the local strains showed them to be superior to the standard varieties in respect of yield and rust resistance.

1505. 633.11–1.557:575
Pisarev, V. S. 633–1.557:575
(Breeding for productivity).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 9–10 : 184–201.
The empirical methods used by Nilsson Ehle and Lysenko in the selection of parent forms for crossing to obtain high yielding strains are criticized and on the basis of his observations on Siberian wheats the author has evolved the following formula showing the components of yield for cereal crops: the yield = (A x B) x (C x D x E), where A = number of plants harvested per unit of area; B = number of stems bearing ears, per plant; C = weight of one grain; D = number of spikelets in the ear; and E = number of grains in the spikelet. A similar formula could, it is claimed, be evolved for flax and legumes and other crops.
An understanding of the effect of environment on the relative proportions of the components of yield is essential in breeding for high yield so that parents of the necessary ecological types which have been tested in suitable environment and in which certain components are sufficiently pronounced may be selected to produce the required combination in the progeny.
By crossing Novinka, an early wheat of high milling and baking quality, with 13 Gamma-beta, which is a low yielder but with a large number of grains to the ear, a series of strains were obtained which were as early as Novinka and also gave a much higher yield; the strain GDS 24, having the most favourable combination of the quantitative characters of the parents for yield, is regarded as a possible source of selections that may prove serious competitors of the Canadian wheat Garnet.
The breeder desiring early high yielding types should cross two early forms that differ in their relative proportions of the components of yield, such complementary features being of vital importance in the choice of the parent combinations.
Some successful work on similar lines with oats is also mentioned; and it is suggested that an analysis of various wheats of lesser importance as regards their yielding capacity should be made with a view to the discovery of valuable components for use in subsequent crosses for high productivity.
Tests have been begun on the response of yield components of various plants to environment, e.g. manuring and some results obtained with wheat might, it is claimed, be used as a basis of selection of parental combinations to obtain types with the maximum response to manuring.

1506. Quisenberry, K. S. 633.11–2.111–1.521.6:575
Survival of wheat varieties in the Great Plains Winterhardiness Nursery, 1930-1937.
J. Amer. Soc. Agron. 1938 : **30** : 399–405.
A summary is presented from data obtained in winter-hardiness nurseries in the Great Plains of the northern U.S.A., and in Canada from 1930 to 1937. Of the new strains produced by experiment stations none have been hardier than Lutescens 0329 and Minhardi, but progress has been made in combining winter-hardiness with grain quality and yield.

1507. Isenbeck, K. 633.11–2.112–1.521.6:575
Beobachtungen, Erfahrungen und Gedanken zur Dürreresistenz des Weizens als Züchtungsproblem. (**Observations, experiences and thoughts on the drought resistance of wheat**).
Pflanzenbau 1938 : **14** : 401–26.

During the six years 1931–1936 the behaviour of winter and spring wheat varieties to drought was carefully studied.

Those types which showed a rapid and luxuriant development in early spring were unable to stand up to drought at a later period while the slower growing forms with less demand on the moisture content of the soil were able to mature relatively satisfactory grains. Other forms were definitely susceptible to drought and some even failed to ear. The drought-resistant varieties were those that produced a relatively high quantity of straw, a good 1,000 grain weight and a satisfactory yield.

A comparison of various characters of spring and winter varieties showed that the variation from year to year is greater in the spring wheats and that the 1,000 grain weight shows the least variation, culm length and yield the greatest. Some varieties showed themselves to be more adaptable to changes in climatic conditions than others.

The results are discussed from the point of view of breeding for resistance to drought.

1508. Rodenhiser, H. A. and
Quisenberry, K. S. 633.11–2.451.3–1.521.6:575
Bunt reaction of some varieties of hard red winter wheat.
J. Amer. Soc. Agron. 1938 : **30** : 484–92.

Extensive data are given showing the reaction of varieties and hybrid selections of hard red winter wheat to composite bunt inoculum (*T. levis* and *T. tritici*) in bunt nurseries throughout the Great Plains during the years 1932–1937. The varieties Oro, Martin and Hussar, and Minturki to a limited extent, contributed factors for resistance in hybrid lines.

1509. 633.11–2.452–1.521.6(75.9)
Miller, J. H. 633.11:575.127.5:633.14
Diseases of small grains in Georgia.
Plant. Dis. Reporter 1938 : **22** : 176–77.

Inter alia, it is mentioned that Wharten, a rye-wheat hybrid was more resistant to both stem and leaf rust than any wheat variety in the agronomy plots at Athens. It is not, however, uniform for rust resistance.

1510. Moroškina, O. S. and
Akimova, A. S. 633.11–2.7–1.521.6
(**On varieties of spring wheat resistant to damage by tipulids**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 16–17.

The variety Melanopus 4121, having very solid straw, was more resistant to attack than the standard varieties and its use in breeding is recommended.

1511. 633.11–2.7–1.521.6:575.127.5
Jones, E. T. 633.11 *Aegilops*–2.7–1.521.6
Infestation of grasses of genus *Aegilops* by the Hessian fly.
J. Econ. Ent. 1938 : **31** : 333–37.

Of the 22 *Aegilops* strains tested, representing 11 species, strains of *Ae. cylindrica* and *Ae. ventricosa* were resistant and are possible sources of resistance factors for breeding work.

Some selections from wheat—*Aegilops* hybrids were also tested for resistance. An F_6 of *Ae. triuncialis* x *T. durum* variety Pelis and an F_4 of *Ae. triuncialis* x Purple-seeded *T. durum* were resistant. Another selection of the latter cross appeared to be segregating for resistance and the remaining hybrids were susceptible.

1512. Murav'ev, P. A. 633.11:664.641.016(47)
(Baking qualities of winter and spring wheat bred at Odessa).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 32–37.
Notes on well known varieties and promising Odessa strains.

1513. Ausemus, E. R.,
Markley, M. C.,
Bailey, C. H. and
Hayes, H. K. 633.11:664.641.016:519.241.1
Quality studies in the wheat-breeding program at the Minnesota Agricultural Experiment Station.
J. Agric. Res. 1938 : **56** : 453–64.
From the data obtained in the wheat-breeding work during the years 1927–33 the inter-annual, inter-station and inter-character correlation coefficients for the following characters are given: test weight, wheat protein, milling yield, water absorption of dough, loaf volume and colour, texture and grain of the cut crumb of the loaf.
Inter-annual correlations tended to be low, with the exception of crumb colour. Inter-station correlations were significant but small.
There was a close relation between loaf volume and colour, texture and grain of the crumb. The correlations between test weight, protein content and milling yield were low.

1514. 633.11:664.641.016:575
633.16:663.421:575
Isenbeck, K. 633.63:575
Die Entwicklung des Qualitätsgedankens in der landwirtschaftlichen Pflanzenzüchtung. (**The development of the concept of quality in agricultural plant breeding**).
Kühn-Arch. 1938 : **50** : 275–314.
Breeding for quality, as opposed to yield, is a comparatively recent development in agriculture but one which, because of political and economic conditions is of increasing importance in most European countries. The development of breeding for quality in sugar beet, barley and wheat is reviewed in this paper and includes a consideration of the possibilities as well as difficulties and the means employed to produce the optimal combination of yield and quality.

1515. Klein, E. 633.11:664.641.016:575
El mejoramiento de la calidad industrial en los trigos, métodos empleados y sus alcances. (**Methods employed in breeding wheat for quality**).
Arch. Fitotécn. Uruguay 1937 : **2** : 189–203.
The value of various methods, including determination of the water absorption and gas production and a modification of Rosenstiel's micromethod as well as the methods of Pelshenke, Brabender and others, in breeding for quality are illustrated by reference to the author's own work with a large number of crosses with the high quality variety Klein-Otto Wulff.

1516. Ruebenbauer, T. 633.11.0014(43.8)
Doświadczenia z odmianami pszenicy ozimej przeprowadzone w Polsce w latach 1923–1936. (**Field trials with winter wheats conducted in Poland during 1923-1936**).
Wydaw. Sekcji Nasiennej Przy M.T.R. w Krakowie i Zakładu Hodowli Roślin i Doświadczalnictwa U.J. Kraków 1937 : No. 17 : Pp. 50.
An account of studies on yields of several varieties of winter wheats from nearly 1,000 field experiments.
Starting with Flaksberger's and Vavilov's classification, the author divides the wheats cultivated in Poland into two fundamental groups: (1) proper for more humid climate and (2) suitable for more arid climate. To the last group belongs, according to the author's opinion,

the variety "Banatka" and some local varieties obtained from "Banatka" by means of selection.
Besides the ecological characteristics of the varieties, the author discusses their fitness for agricultural practice and tries to select the best for each region.
Describing the climatic conditions in the individual regions, the author tries to find the influence of some climatic conditions on the relative yields of different varieties of wheat.

Y. P.

1517. Pullman, I. 633.12:575(47)
(Results of my work). 633.14:575(47)
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 34–37.

Dr Pullman replies to the criticisms made in an earlier article (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 823), and maintains that his yellow-grained ryes are superior both in yield and quality to green-grained varieties and that his buckwheats represent a real improvement on the local forms. Reference is also made to the production by inbreeding of a rye with smooth keeled glumes.

OATS 633.13

1518. Nishiyama, I. 633.13:575.127.2:581.162.5:537.531
(Hybridization and application of X-rays).
Bot. and Zool. 1935 : **3** : p. 2032.

Similar results to those previously recorded (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 637) were obtained by pollinating diploid species of oats with hexaploid pollen that had been subjected to X-rays. Fairly plump seeds developed, some of which germinated, though imperfectly.

1519. Zalesov, F. V. 633.13:575.42(47)
(New varieties of oats).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 21–22.

Descriptions are given of a number of new varieties selected for various parts of the Krasnojar steppes on the score of drought resistance, large grain, thin husk and earlier maturity than the standards Golden Rain and Victory. Two of them, numbers F.194 and Y.883, both selections from Probsteier, are especially promising.

1520. Vasconcellos, J. de Carvalho e 633.13:581.46
Algumas anomalias observadas nas aveias. **(Certain anomalies observed in oats).**
Rev. Agron., Lisboa 1936 : **24** : 116–19.

Two anomalies are described: (1) dichotomy of terminal floret; (2) spikelets with one or two supernumerary florets above the two normal florets, producing naked grains and having a flexuose rachilla, thus resembling *A. nuda*, which was not however present in the vicinity. Observations are being made to test whether the anomalies are hereditary.

1521. Vasconcellos, J. de Carvalho e 633.13:581.46:575.242
Uma curiosa mutação na aveia. **(A curious mutation in oats).**
Rev. Agron., Lisboa 1936 : **24** : 487–92.

The second of the two anomalies previously described (see Abst. 1520) was studied.
Abnormal spikelets occurred in all the plants of the strain, though not in every panicle; the proportion of abnormal spikelets per plant varied from 7 to 19 per cent, with an average of 12·8 per cent. The proportion of naked grains was somewhat less than the proportion of anomalous spikelets. The anomaly occurred more frequently in well developed panicles and is considered to be a regressive mutation. No naked oats were growing in the vicinity.

RYE 633.14

1522. 633.14:575(47)
SMIRNITSKAJA, M. 633.14–2.111–1.521.6
(Problems and results in rye breeding at the Kharkov Breeding Station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 48–50.

The importance of breeding varieties of winter rye with high yield and quality combined with resistance to cold, lodging and disease has been a recognized aim at this station for many years. Work in this direction has led to the production of the Petkus strain of winter rye No. 194 (bred from strain No. 950) (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 647) and the Nemyšljansk strain No. 953, here described. Still further improvements in the No. 194 are contemplated.

1523. CASTRO, D. Duarte Manuel de 633.14:576.356:581.036
Estudo sôbre a influência do calor na meiose do centeio. **(Study on the influence of heat on the meiosis of rye).**
Rev. Agron., Lisboa 1937 : **25** : 120–39.

The ears of rye were subjected at the time of pollen mother cell development to temperatures ranging from 35 to 50° C. for one hour. The treatment was found to favour the production of clear pachytene figures, the optimum temperature for this being 35° C. Certain anomalies were already detectable at this temperature. In certain cells the attachment of the nucleolus to the secondary constriction of one of the chromosomes was clearly visible. Among the other anomalies observed in the treated material were the presence of bivalents emerging from the nucleus, the attachment constrictions having lost their kinetic powers, fragmentation, translocation, delayed separation (apparently owing to retention of chiasmata; these chromosomes sometimes ultimately break, probably as a result of the electrostatic repulsion between the attachment constrictions), unequal distribution to the poles, and the passage of an unseparated bivalent to the poles. By this latter means trisomic and monosomic plants could originate. Certain tetraploid cells were also observed.

1524. LEITH, B. D. and 633.14:581.162.5:575
SHANDS, H. L. 633.14 Imperial
Fertility as a factor in rye improvement.
J. Amer. Soc. Agron. 1938 : **30** : 406–18.

By selection in inbred lines it was found possible to increase the percentage set after selfing from a few per cent. to an average of 50 per cent. Vigour was usually reduced in inbred lines and many undesirable segregates appeared.

Some, but not all of the hybrids produced by allowing inbred lines to cross were more vigorous than open-pollinated rye. The fertility on selfing of the hybrids was about the same as that of the selected inbred lines. It is not yet determined whether it is possible to improve the fertility of the hybrid lines by selection.

The selection of the rye variety Imperial from Schlansted rye is also described briefly. Open-pollinated lines were selected for high fertility, large heads and plump, large, white kernels. After five years of selection seven of the better lines were combined to form the new variety.

MAIZE 633.15

1525. 633.15:575(44)
635.652:575(44)
PIAT. 633.491.00.14
Station de génétique et de culture du maïs du sud-ouest. Rapport sur les travaux de la station pendant l'année 1937. **(The station of maize genetics and cultivation in the south-west. Report on the work of the station in 1937).**
Chambre d'Agriculture des Basses-Pyrénées 1938 : Pp. 20.

The aim has been the production of a high yielding type earlier than those generally cultivated.

About 200 of the 1,000 lines tested have been retained. Crosses have also been made and the F_2 progeny of some are being grown. Work on the improvement of the quality of the haricot bean is in progress and some experiments with potatoes are noted.

1526. Moșneaga, V. 633.15:575(49.8)
Ameliorarea porumbului in România. (The improvement of maize in Rumania).
Viață Agric. 1938 : **29** : 69–79.
After a short account of the work already accomplished in maize breeding throughout Rumania the present position of the subject is reviewed and the possibilities for further improvement are discussed.

1527. Wallace, H. A. 633.15:575(73)
Corn breeding experience and its probable eventual effect on the technique of livestock breeding.
Spragg Memorial Lectures on Plant Breeding, Mich. St. Coll. 1938 : 8th Annu. Lect. April 21 : Pp. 16.
The United States Secretary of Agriculture reviews briefly the history of maize breeding in the U.S.A. and estimates that in 1938 at least 15,000,000 acres of hybrid maize will be planted. The application of the knowledge gained from maize breeding to animal breeding is discussed and eugenical problems are also considered.

1528. Johnson, I. J. and
Miller, E. S. 633.15:575.11.061.6:577.16
Variation in carotinoid pigment concentration among inbred and crossbred strains of corn.
Cereal Chem. 1938 : **15** : 345–50.
In the mature grain of 19 inbred lines varying in intensity of yellow colour, the percentage of total carotinoid pigments was found to vary from ·0001 to ·0017. The carotinoid pigment content was not closely associated with the intensity of yellow endosperm colour.
Crosses were made to provide the four endosperm genotypes *YYY*, *YYy*, *Yyy* and *yyy* to study the relation between number of genes for yellow endosperm and concentration of carotinoid pigments. The relative contents of total carotinoids were *YYY* 3·3, *YYy* 2·0, *Yyy* 1·0 and *yyy* 0·3 and of beta carotin 3·1, 1·9, 1·0 and 0·3. There is thus a direct proportionality, agreeing with the results for vitamin A (Cf. "Plant Breeding Abstracts", Vol. I, Abst. 523).
There did not appear to be any relationship between carotin in endosperm and carotin in the seedling tissue. There was a positive association between carotin and chlorophyll in leaf tissue.

1529. Bascialli, P. C. 633.15:575.12
Métodos modernos para la obtención de híbridos comerciales de maiz. (**Modern methods for obtaining commercial hybrids of maize**).
"Granos" Semilla Selecta, B. Aires 1938 : No. 4 : 3–15.
The methods employed in the U.S.A. are described and illustrated.

1530. Stringfield, G. H. 633.15:575.12(77·1)
Data and notes on certified corn hybrids for Ohio.
Bi-m. Bull. Ohio Agric. Exp. Sta. 1938 : **23** : No. 191 : 29–38.
Data are given on the yield of grain, percentage of dry matter in ears at harvest and percentage lodging for early and late hybrids in Ohio. Brief notes are given on the hybrids, with indications of the parts of the state for which they are suitable.

1531. Dungan, G. H. 633.15:575.12(77·3)
The rise of hybrid corn.
Trans. Ill. Acad. Sci. 1937 : **30** : 54–55.
Data are given showing the increase in the advantage of maize hybrids over open-pollinated varieties in Northern and Central Illinois from 1927 to 1936. In 1936 the five best hybrids outyielded the five best open-pollinated varieties by 36 per cent in Northern and 49 per cent in Central Illinois. Even the five worst hybrids exceeded the five best open-pollinated varieties by 5 per cent.

1532. Bukasov, S. 633.15:575.127.5
Un probable híbrido de maiz y *Euchlaena mexicana.* (**A probable hybrid of maize and *E. mexicana*).**
Rev. Argent. Agron. 1938 : **5** : 113–15.
Indications are given as to the distribution of the genus *Euchlaena* in Mexico. Among the plants collected one appeared to be a natural hybrid with maize. The plant is described.

1533. Rhoades, M. M. 633.15:575.242:575.11.061.633
Effect of the *Dt* gene on the mutability of the a_1 allele in maize.
Genetics 1938 : **23** : 377–97.
Evidence is presented to show that the coloured dots on a_1A_2CRDt maize grains are due to mutations of a_1 to A_1 under the influence of *Dt* (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 849). *Dt* causes the mutation a_1 to A_1 to occur in all parts of the plant and when sporogenous tissue is affected the change is inherited. The patches of mutant tissue are almost always small, indicating that the mutation tends to occur at later stages of development. Mutation of a_1 to a_1^p (Cf. loc. cit.) also occur under the influence of *Dt* but only with about one thousandth of the frequency of a_1 to A_1.
Evidence was obtained of an incompletely dominant modifier *M*, reducing the frequency of coloured dots on the grain.
There is a possibility that *Dt* is linked with *C* on chromosome IX.
It is pointed out that the stability of a_1 in the presence of *dt* and its mutability in the presence of *Dt* suggests that there is no fundamental difference between stable and mutable genes and other bearings of the present case on mutation theory are discussed.

1534. Beadle, G. W. 633.15:576.356:575.11
Chromosome aberration and gene mutation in sticky chromosome plants of *Zea mays*.
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 43–56.
Further studies on the effect of the gene *st* (Cf. "Plant Breeding Abstracts", Vol. III, Abst. 419).
In plants of the constitution *ststAaBbPlpl* sectors differing in colour from the surrounding tissue were produced by the loss of *A*, *B* or *Pl* by chromosome elimination. *B* was lost more frequently than *Pl* and *Pl* more often than *A*. Similarly in endosperm of the constitution *st*; *Ccc* colourless patches occurred in the aleurone layer. Endosperm homozygous for the *st* gene is characteristically scarred, a phenomenon which is apparently also due to chromosome elimination.
The frequency of chromosomal rearrangements, mainly reciprocal translocation, was 1 in 64 in the progeny of *st* plants as compared with 1 in 594 in the controls. The corresponding figures for apparent gene mutations were 1 in 49 as against 1 in 379. In only one case did a gene mutation occur coincidentally with a chromosome rearrangement and even in this case the two were inherited independently.
Some white-striped plants occurring in the F_1 of the cross *st* x bm_1 and not being transmitted further are tentatively ascribed to "Dauer"-modification.

1535. Anderson, E. G. 633.15:576.356.2
Translocations in maize involving chromosome 9.
Genetics 1938 : **23** : 307–13.

Data are given on the linkage of a number of chromosome 9 translocations with the waxy gene. The cytological position of the translocations, as measured at mid-prophase of meiosis, shows good agreement with the amount of crossing-over with waxy.

1536. McClintock, B. 633.15:576.356.2:575.242:537.531
The production of homozygous deficient tissues with mutant characteristics by means of the aberrant mitotic behaviour of ring-shaped chromosomes.
Genetics 1938 : **23** : 315–76.

A ring chromosome usually divides normally at mitosis but in a proportion of cases aberrations occur. The frequency and nature of these aberrations depends on the size of the ring. A large ring gives rise to a double-sized ring, possibly by a form of crossing-over between the two chromatids, and the double ring at anaphase gives a double bridge; this breaks at telophase and the broken ends evidently rejoin, as rod chromosomes are never produced from rings. Smaller ring chromosomes also give rise to double-sized rings, but aberrations in their case usually lead to loss of the ring. Asymmetrical breakage of double-sized rings leads to changes in size of the ring chromosome. In general, the larger the ring, the more frequent the aberrations. The behaviour of the ring chromosomes and deficient chromosomes at meiosis is also described.

The genetical effects of these aberrations were studied in the case of two small rings produced from chromosome V, by X-ray irradiation. Each included the locus of *Bm* 1, the normal allelomorph of brown midrib, *bm* 1 and each had a part of the spindle attachment, which enabled them to participate in mitosis. One of them, R1, was 1/20 of the length of the chromosome and the other, R2, about 1/7. The corresponding deficient chromosomes Def 1 and Def 2, also had part of the spindle attachment and behaved normally at mitosis.

If a plant had two normal *bm* 1 chromosomes and one of the rings or a deficient chromosome, a *bm* 1 chromosome and a ring, the losses of the ring chromosome at mitosis produced variegation for *Bm* 1 and *bm* 1. The sectors of *bm* 1 tissue were more frequent when R2 was the ring chromosome, as expected from the behaviour observed at mitosis. Even rarer *bm* 1 sectors were produced when both rings were carried, for both had then to be lost to produce *bm* 1 tissue.

The functional ability of gametes carrying different combinations of deficient and ring chromosomes is described. Though Def 2 + R2 pollen and ovules function normally, Def 1 + R1 or Def 1 + R2 pollen grains very rarely function; this may be a position effect but the possibility of a net deficiency in such gametes is not excluded.

Plants with Def 1/Def 2 + R2 were a uniform mosaic of tissues homo- and heterozygous for the full extent of the deficiency in Def 1 owing to losses of the ring chromosome at mitosis. Moreover the patterns of the double deficient plants with various combinations of ring chromosomes agreed very well with those predicted. The homozygous deficient tissues have the phenotypic expression of *bm* 1 in the cell walls.

Plants homozygous for Def 2 R2 have also been produced. They have 22 chromosomes, without any increase in genetic material. Loss of both R2 chromosomes produces cells homozygous for the deficiency in Def 2. These cells are short-lived and degenerate before maturity of the neighbouring cells; they can only be detected by microscopic examination. Somatic alterations in the constitution of a ring chromosome carried by plants which have two deficient chromosomes produce modified tissues having mutational characteristics (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 837).

Numerous points of great theoretical interest emerge from the work.

1537. Jones, D. F. 633.15:576.356.2:575.25
Translocation in relation to mosaic formation in maize.
Proc. Nat. Acad. Sci., Wash. 1938 : **24** : 208–11.

Evidence is presented of translocations occurring somatically in maize endosperm. They produce paired mosaic spots in which genes lying in different chromosomes disappear simultaneously.

1538. Kempton, J. H. and Popenoe, W. 633.15:581.9(72.81)
Maize investigation.
Yearb. Carneg. Instn 1936 : No. 35 : 138–40.
A study of the distribution of *Euchlaena* in Guatemala by an expedition in 1935 showed that teosinte at the present time is more abundant and less restricted to cultivated areas in Guatemala than in Mexico. In so far as this plant is concerned in the ancestry of maize, it is considered that the most probable region for the origin of maize would appear to be the highlands of western Guatemala.

1539. Patch, L. H., Bottger, G. T. and App, B. A. 633.15–2.7–1.521.6:575.12(77.4)
633.15 Michigan Hybrid No. 561
Comparative resistance to the European corn borer of two hybrid strains of field corn at Toledo, Ohio.
J. Econ. Ent. 1938 : **31** : 337–40.
Michigan Hybrid No. 561 has been reported (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 200) to be resistant to European corn-borer (*Pyrausta nubilalis*). In the tests here reported it was found to have no advantage over comparable, known susceptible strains in respect of number of mature borers surviving from a given number of eggs, nor of the deposition of eggs by the moths in nature, nor of the reduction in yield of grain by a given number of borers.

BARLEY 633.16

1540. Robertson, D. W. and Wiebe, G. A. 633.16:575.11:001.4
633.16:575.116.1
Genetic factors in barley.
U.S. Dep. Agric. Pp. 25. (Mimeographed).
A list of the factors known in barley with symbols proposed for standardization is given, followed by a summary of linkage studies with this crop. It is planned to add to the list from time to time.

1541. Bonnett, O. T. 633.16:581.162.32:578.08
Seed setting and average seed weight as affected by two methods of opening barley flowers for emasculation.
J. Amer. Soc. Agron. 1938 : **30** : 501–06.
The experiments here reported show that slitting the lemmas is a better method of opening barley flowers for emasculation than cutting off the lemmas and paleas just above the tips of the anthers. The former method gives heavier seeds and a higher percentage set.

1542. 633.16–2.111–1.521.6(47)
Koràblin, I. I. 633.16:575.127.5
(New varieties of barley bred at Omsk).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 57–59.
A description of the history of the selection and breeding experiments at the Omsk Station where the chief aim has been to combine high yield and quality with resistance to spring frost and drought. Various Pallidum (e.g. No. 010664 which has in some respects surpassed Boets Pallidum) and other successful strains are described (Cf. also "Plant Breeding Abstracts", Vol. VI, Abst. 892).
The potential value of *Hordeum* x *Elymus* hybrids as a hardy crop for waste lands is discussed. From such a cross 107 hybrid seeds were obtained and sown for observation.

1543. 633.171:575(47)
ORLOV, P. 633.171–1.531.12(47)
(Problems of breeding and seed production with millet).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 49–51.

The unsatisfactory state of affairs that has existed in the U.S.S.R. in regard to millet selection and breeding is outlined and improved methods are suggested for future work with a view to obtaining varieties of high yield, quality and resistance to disease and lodging combined with other desirable features. Ecological types are also discussed and mass selection is recommended for certain regions together with a scheme for the regional distribution of particular varieties. Vernalization should be applied in variety trials.
Seed production is also discussed.

1544. KISHIMOTO, E. 633.171:576.312.35
Chromosomenzahlen in den Gattungen *Panicum* und *Setaria* I. Chromosomenzahlen einiger *Setaria*-Arten. **(Chromosome numbers in the genera *Panicum* and *Setaria* I. Chromosome numbers of some *Setaria* species).**
Cytologia, Tokyo 1938 : **9** : 23–27.

The following numbers are recorded: *S. italica* (L) P.B., 2n = 18; *S. viridis* Beauv., 2n = 18; *S. Faberii* Herrm., n = 18, 2n = **36**; *S. lutescens* Hubbard [= *S. glauca* (L). P.B.] n = 18, 2n = 36; *S. geniculata* Beauv., n = 36, 2n = 72. Pollen grain size increased with chromosome number.

1545. IRELAND, J. C. 633.174–1.557:519.241.1
Sorghum characters grouped by multiple correlations.
J. Agric. Res. 1938 : **56** : 707–10.

From the correlations of 13 characters with yield in the progeny of a sorghum cross, from 1929 to 1936, it is concluded that it is doubtful whether yields can be predicted from these characters.

RICE 633.18

1546. KOSAKA, H.,
MIYASHIRO, J., and
YASUKAWA, D. 633.18:575.11.061.6
(Studies in the response to unfavourable growing environments of certain varieties of rice plant).
Proc. Crop Sci. Japan 1936 : **8** : 313–40.

Three forms of varietal response were identified and a detailed study was made of morphological and physiological reactions to environment.
Five types of Lowland rice were distinguished on the basis of anthocyanin distribution in the vegetative organs, the genes concerned in pigmentation and the amounts and nature of the pigments present.
Genetically the presence of anthocyanins in the vegetative parts of rice plants appears to be due at least to a pigmentation gene *C* and an enzyme gene *R*; while the dark reddish purple or blackish purple is due to the gene *B* acting in conjunction with *C* and *R*.
The above-mentioned five types comprised Shito (purple rice) with the constitution *CRB*; Aikoku, *CRb*; Sekitori, *Crb*; Kameno-o, *cRb*; and Fusakichi, *crb*.
Other genetic types of course exist, and further research on the subject is necessary.

1547. 633.18:581.162.5:581.483:575.116.1
TAKAHASHI, N. 633.18:581.331.23
Studies on the linkage relations between the factors for endosperm characters and sterility in the rice plant, with special reference to selective fertilization.
Bull. Agric. Exp. Sta. Chosen 1936 : No. 5 : Pp. 74.

The factor pair *U* (starchy endosperm)— *u* (glutinous endosperm) was found to be linked

with another factor pair affecting fertility, *D* (fertile) — *d* (sterile). Only 2·2 per cent crossing-over occurred. Marked deficiencies of *d* plants occurred in families segregating for this character and in the progenies of double heterozygotes (*DU/du*) deficiencies in glutinous plants also occurred. This is ascribed to competition between *d* and *D* pollen grains the latter effecting fertilization about 1·5 times as often as the former (100 *D* : 64 *d*). Plants carrying *dd* are only about 17 per cent fertile and have only about half the number of spikelets per ear of *D* plants. The factor pair *U* — *u* had no influence on fertility.

1548. Capinpin, J. M. and Pangalangan, M. D. 633.18–1.557:575.14
Commercial tests of selected Elon-elon rice strains produced by inbreeding.
Philipp. Agric. 1938 : **27** : 3–17.

In the 1933–34 season 71 single plant progenies obtained by selfing plants selected for vigour from the variety Elon-elon were grown and of them 31 were selected on the basis of tillering and yield. From these 31 in 1934–35, 7 lines were selected and tested in 1935-36 in replicated plots. Four were apparently superior to the parent variety and it is the test of these four lines against the parent variety in 1936 37 which is here reported. Three of them yielded significantly more than the control and of these the two highest yielders also gave significantly more tillers than the control.
It thus appears that from the commercial variety Elon-elon different genotypes can be segregated for yield by one generation of inbreeding.

HERBACEOUS FORAGE PLANTS 633.2

1549. Sengbusch, R. v. 633.2/3:578.081:575
Züchterische Methode zur Bestimmung der Qualität von Futterpflanzen. (Vorläufige Mitteilung). [**Breeding methods for the determination of the quality of fodder plants. (Preliminary communication)**].
Pflanzenbau 1938 : **14** : 444–47.

The total weight of the green parts of the plant and strains is determined and then an equal weight of water added. The still whole material is boiled for three hours in a closed flask, frequently shaken and when cool measurements are made with the refractometer.
The advantages and difficulties of the method are described.

LEGUMINOUS FORAGE PLANTS 633.3

1550. Atwood, S. S. 633.322:581.45:575.242
A "one-leaved" white clover. Unifoliolate mutation appears among 10,000 plants.
J. Hered. 1938 : **29** : 239–40.

The unifoliolate plant produces practically all unifoliolate leaves, with a few bifoliolate, trifoliolate, bilobed and trilobed leaves. The inheritance of the character has not been studied as the plant has not flowered. It is being maintained by cuttings. The somatic number of chromosomes is the normal 32.

1551. Hackbarth, J. 633.367:581.192:575
Die Abhängigkeit des Ölgehaltes einiger Lupinenarten von äusseren und inneren Faktoren. (**The dependence on external and internal factors of the oil content of some species of lupin**).
Züchter 1938 : **10** : 145–50.

From this survey of the effect of soil, climate and time of sowing on the oil content of lupin species, the following considerations are of interest to the plant breeder.
The oil content of *L. albus* is an inherited character which is readily modified by external conditions. More oil is obtained on the better types of soil than on light sandy soils. A good rainfall in June and sunshine in July and August has a favourable effect on the oil content and early sowing is recommended. Individual strains and strains of different origin respond differently and these facts should be taken into consideration when making variety tests. As there is no correlation between oil content and seed size or between protein content and time of ripening, there are possibilities for a combination of desirable characters.

1552. SCHNEIDER, F. 633.41:575.127.2:633.63:576.312.35
Nouvelle communication concernant la deuxième génération du croisement de *Beta trigyna* x la betterave à sucre. (A new communication concerning the second generation of the cross *B. trigyna* x the sugar beet).
Publ. Inst. Belge Amélior. Better. 1937 : **5** : 542–43.

The F_1 of this cross is sterile (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 194); an F_2 and an F_3 were therefore obtained by back-crossing with the sugar beet. Most of the plants of both generations had 2n = 27 chromosomes.

A new F_2 of over 100 plants was produced by back-crossing the original F_1 hybrid to sugar beet. This time there were segregations both for external characters and for chromosome number.

Though the majority of the plants had 27 somatic chromosomes a certain number had 2n = 36 and it is possible that other numbers may yet be found. The plants with the largest number of chromosomes showed gigas characters and these all resembled *B. trigyna*. Some of the plants with the higher chromosome number exactly resembled the sugar beet. Determination of the physiological qualities of the root have not yet been made.

In the second part of the paper other types of the section *Corollinae* are figured,—particularly *B. lomatogona*.

The third part is devoted to a microscopic examination of the roots at germination in *B. trigyna*, the sugar beet and the F_1 and F_2 hybrids. The differences between the diploid and tetraploid roots are distinctly visible.

1553. SCHWARZ, P. A. 633.491:575.127.2:576.356.5
Cytogenetic investigation of the potato. I. Interspecific hybrids (*S. phureja* x *S. Rybinii*) x *S. acaule*].
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 59–67.

The *S. phureja* x *S. Rybinii* F_1 varied in size, form and colour of tubers, depth, form and colour of eyes, colour of sprouts and stem colour, resembling *S. phureja* in form and colour of leaves and flower colour. Certain other characters are indicated as being intermediate. The size of the plant was greater than either parent, as was also the size of the stomata. Variation occurred also in respect of starch content and fertility. All the 15 hybrids obtained were crossed with *S. acaule* var. *subexinterruptum* but seed was obtained only from one. The resulting triple hybrids resembled *S. acaule* in habit, variation being observed in a number of characters, and some formed tubers. The pollen was of low viability, varying from 2.15 to 6.3 per cent and no seed was obtained from it either in self-pollinations or crosses with other species.

The somatic chromosome number of the *S. phureja* x *S. Rybinii* hybrids was 24 like the two parents and the reduction division was fairly normal. The triple hybrid had 36, *S. acaule* being a tetraploid with 2n = 48. Various irregularities were observed in the reduction division but 12 of the *S. acaule* chromosomes conjugated with those of the hybrid, and some of the other 12 paired autosyndetically. Occasional trivalents were observed. This behaviour lends support to the view that 6 is the basic number for *Solanum*.

1554. NAKAMURA, M. 633.491:576.356.5
Cyto-genetical studies in the genus *Solanum*. I. Autopolyploidy of *Solanum nigrum* Linn.
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 57–68.

The 12-chromosome form previously ascribed to *S. nigrum* (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1282) has been separated as a new species, *S. photeinocarpum* Nakamura et Odashima. *S. nigrum* (n = 36) inhabits the temperate region of the Japanese empire while *S. photeinocarpum* (n = 12) is confined to the sub-tropical and tropical parts. Herbarium material indicates that the latter species is also found in India, the Philippines and the Canary Islands, while material from Central Europe, Sweden and North America is typical *S. nigrum*.

S. photeinocarpum has a regular meiosis with 12 bivalents, while in *S. nigrum* quadri- and sexivalents were observed. As many as 8 sexivalents were seen in one cell though in others 36 bivalents occurred. It is concluded that *S. nigrum* is an autohexaploid.
The flowers, fruits, seeds, stomata, pollen grains, palisade cells and epidermal cells of *S. nigrum* were larger than those of *S. photeinocarpum.* Each species produces less than 4 per cent of empty pollen grains.

1555. Stier, H. L. 633.491:581.142
The effect of certain seed treatments on the germination of recently harvested potato seeds.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 601–05.
Several treatments were tested with the object of increasing the rate of germination of newly harvested potato seed. The only treatments which did so were removal of the testa and excision of the radicle. The best temperature for germination of recently harvested, imbibed seeds was 20° C.

1556. Krantz, F. A. 633.491:581.143.7:575"793"
Maturity of potato seedlings in the greenhouse and their later behavior in the field.
Amer. Potato J. 1938 : **15** : 153–57.
Breeding progenies of potatoes raised in the greenhouse from true seed show significant differences in time to maturity, as was shown by a randomized block experiment. Early varieties in general tend to give early-maturing seedlings. The effect of position in the greenhouse was also significant.
When the same seedlings were later grown as clones in the field it was found that there was a positive correlation between the times to maturity in the field and greenhouse. Moreover when the data from greenhouse and field were combined in an analysis of variance it was found that though there were significant differences between families in time to maturity, the interaction between families and location (greenhouse or field) was not significant.
Data on maturity in the greenhouse may therefore be combined with those from the field to increase the reliability of the estimate of the breeding value of a parent for early maturity.

1557. Kokhanovskaya, L. N. 633.491:581.162.52
Physiological sterility in the cultivated Columbian potato *Solanum Rybinii* Juz. and Buk.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 281–84.
Embryological studies showed that after self-pollination the pollen tubes in *S. Rybinii* fail to reach the ovary before the flowers drop off. Pollen of *S. goniocalyx* reaches the ovary of *S. Rybinii* in 24 hours. It is concluded that *S. Rybinii* is self-incompatible.

1558. 633.491–2–1.521.6:575
Schick, R. 633.491–1.524.2(8)
Die Züchtung von Fabrikkartoffeln unter besonderer Berücksichtigung südamerikanischer Ausgangsformen. (**The breeding of industrial potatoes with special reference to South American parental forms**).
5th Congr. Int. Tech. Chim. Industr. Agric. Schéveningue 1937 : 349–62.
It is suggested that the present-day European potato varieties are largely derived from crosses between *Solanum tuberosum* and *S. andigenum.* A brief account is given of the wild and cultivated species of South American potatoes.
The possibility of breeding for resistance to the Colorado beetle (*Leptinotarsa decemlineata*) is mentioned. *S. chacoense, S. Commersonii* and *S. demissum* are resistant. The author has a fertile hybrid of *S. chacoense* (n = 12) and *S. tuberosum* (n = 24) with 2n = 48 chromosomes, having arisen apparently from an unreduced egg cell of *S. chacoense.* Ordinary hybrids with 2n = 36 are sterile, but the fertile hybrid may be a useful starting point for breeding work on this problem. Hybrids of *S. chacoense* (n = 12) with *S. demissum* (n = 36) cross fairly easily with other species having n = 24, affording another method of introducing genes from *S. chacoense* into *S. tuberosum.* It is possible too that among the strains bred

for resistance to *Phytophthora* by crossing the domestic potato with *S. demissum* resistance to the beetle may be found.

In addition to *S. Rybinii* (n = 12) the author has found that *S. Kesselbrenneri* (n = 12) and other related forms from the region between Ecuador and Bolivia are highly resistant to virus diseases. The fertile hybrid of *S. chacoense* and *S. tuberosum* also appears to be highly resistant to virus diseases though the ordinary sterile hybrids are not.

The possible value of a frost-resistant variety is pointed out, the species mentioned in this connexion being *S. curtilobum*, *S. ajanhuiri*, *S. Juzepczukii*, *S. demissum*, *S. acaule* and *S. Commersonii*. Owing to the difficulty of testing frost resistance in the laboratory, the author has used field tests. Cross-sterility and hybrid sterility are encountered in using certain of these species. In crossing *S. acaule* (n = 24) with *S. tuberosum* the author obtained some sterile and some fertile hybrids. The sterile hybrids had the expected chromosome number 2n = 48 while the fertile hybrids had 2n = 72, being probably derived from an unreduced egg cell of *S. acaule*.

The breeding work on resistance to *Phytophthora infestans* is reviewed, the use of South American species and the difficulties introduced by the occurrence of physiological races of the parasite being mentioned. As a possible method of circumventing the latter difficulty it is suggested that the incubation period of the disease might be lengthened by breeding.

Alternaria Solani has recently caused serious damage in Europe. Observations in the field suggest that differences in susceptibility occur among the different species, suggesting the possibility of breeding for resistance.

In addition to these adverse factors the question of breeding directly for increased yield must be considered and the question is raised whether the South American potatoes may contribute genes for high yield, the influence of which is obscured in the temperate zone by the short-day requirements of these species. Other factors to be considered with industrial potatoes are the quantity, quality and capacity for hydrolysis of the starch. Work on the last-named property will require close co-operation between the industry and the breeder.

1559. Leach, J. G.,
Krantz, F. A.,
Decker, P., and
Mattson, H. 633.491–2.4–1.521.6:575

The measurement and inheritance of scab resistance in selfed and hybrid progenies of potatoes.

J. Agric. Res. 1938 : **56** : 843–53.

Four methods of obtaining a family mean scab rating were tested; satisfactory results were obtained by taking the mean of all tubers or the mean of all tubers larger than one inch in diameter.

The hybrid progenies were considered in groups having each one parent in common and it was found that the variance of scab ratings between groups was significantly greater than that within groups, illustrating the hereditary nature of differences in scab resistance. It appeared easier, however, to distinguish between the breeding value of parents for scab resistance by the average rating of the selfed progenies than by that of their hybrid progenies from crosses with other parents.

Crosses between resistant parents gave mean scab ratings significantly lower than any other type of cross. Crosses between intermediates (according to the mean scab rating of their selfed progenies) and between intermediate and resistant parents were not significantly different but had lower mean scab ratings than crosses of susceptible with resistant parents, which in turn had lower ratings than crosses of susceptible parents.

1560. Steinbauer, C. E. 633.492:581.142

Methods of scarifying sweet-potato seed.

Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 606–08.

The methods recommended are: (1) for fairly large samples, soaking for 20 minutes in concentrated sulphuric acid and thoroughly washing in water; (2) for small samples filing the seed coat on the funicular end.

1561. 633.51(79.1)
633.51 Hopi

Fulton, H. J.

Hopi cotton, a variable species.

J. Agric. Res. 1938 : **56** : 333–36.

Data are given on 11 strains of Hopi cotton (*Gossypium hopi* Lewton) which have been isolated at Sacaton, Arizona. Lines have been selected breeding true for yellow or white corolla, cream or yellow pollen and smooth or pitted boll surface.

Hopi cotton has small bolls and the seeds are small and sparsely covered with lint. The upper quartile fibre length ranges from 0·82 to 0·98 of an inch in different progenies and the lint is white, strong, fine and silky. As cultivated by the southwestern Indians Hopi cotton is heterozygous and capable of modification by selection.

1562. Laveleye, R. de 633.51:575(67.5)

Étude sur la situation cotonnière dans la plaine de la Ruzizi. (**Study of the cotton situation in the Ruzizi plain**).

Bull. Agric. Congo Belge 1938 : **29** : 3–26.

It was noticed in 1936 that Allen Long Staple cotton cultivated in the Ruzizi plain showed symptoms of degeneration. Analyses made during 1934, 1935 and 1936 confirmed the steady decrease in fibre length and ginning percentage. Comparisons with Allen Long Staple 998 from Tanganyika showed the superiority of selected seed. A programme of the measures to be taken for the improvement of the local cotton is outlined and the results of some researches on yield and fibre and seed characters are given.

1563. Martins, R. G. 633.51:575(81)

O serviço científico do algodão do Instituto Agronômico de Campinas, em São Paulo. (**The scientific service for cotton at the Agronomic Institute of Campinas, São Paulo**).

Bol. Minist. Agric. Rio de J. 1937 : **26** : 81–150.

Of the 70 varieties grown at the station the best 21 have been subjected to varietal tests in connexion with yield, lint percentage, lint length, size of bolls and economic value. Only 7 of these were retained. A number of individual plant selections were subjected to a similar process of elimination. In this way the quality of the Brazilian cotton has been greatly improved. A very considerable contribution to this improvement has been made by Dr Cruz Martins, head of the station, who has produced the variety Piratininga 086 by repeated selection from Texas Big Boll whereby the lint length was increased from 27–28 mm. to 35–36 mm.; the fibre has a cling of 6 grm., lint index is 7·96 grm., the lint percentage is 31·4, boll weight 9·18 grm., weight of 100 seeds 17·4 grm. The plants are 1·6 m. in height and superior in form and resistance.

Descriptions are given of several other varieties produced by the station and their origin is indicated. These varieties have proved superior under local conditions to all imported varieties.

The methods used in cotton breeding are described and the importance of carrying out breeding work in each of the distinct climatic zones and the desirability of having only a single variety in each of these zones are mentioned. For this reason breeding and variety testing are now being carried out in each of the five climatic zones of Brazil.

1564. Mikhailova, K. A. 633.51:576.312.34:575.129

Chromosome morphology of cotton.

C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 181–84.

The chromosome morphology of the 56-chromosome New World cottons agrees approximately but not exactly with the hypothesis that they are amphidiploids derived from the Old World cottons and the 26-chromosome wild American species. Skovsted's division of the New World cotton chromosomes into 26 larger and thicker and 26 smaller and thinner is confirmed, though it is stated that the distinction is not absolute and that the difference in thickness cannot be measured.

1565. Vallega, J. 633.52:581.162.32
Observaciones sobre cruzamientos naturales en el lino. (**Observations on natural crosses in flax**).
Rev. Argent. Agron. 1938 : **5** : 82–86.
Off-type plants observed in many flax fields were isolated and shown to segregate in the progeny, in respect of such characters as flower colour (3 blue : 1 white), height, rust resistance, seed colour, etc. Tests were made of natural crosses by surrounding plants with white flowers and yellow anthers and seeds by plants having blue flowers and brown seeds. The percentage varied with the different combinations of varieties, reaching 24 per cent in certain combinations.

1566. Pavlushin, P. Y. 633.52–2.4–1.521.6:578.081
(**Artificial methods of detecting varieties of flax resistant to diseases**).
Plant Protection, Leningrad 1937 : No. 15 : 34–43.
The best methods of eliciting infection in flax are described for use in breeding varieties resistant to *Fusarium lini*, *Melampsora lini* and *Polyspora lini*. Similar information is also given for tests of resistance to flax sick soils.

1567. Vallega, J. 633.52–2.452–1.521.6
Observaciones sobre la resistencia a la roya de algunos linos ensayados en el instituto fitotécnico de Llavallol. (**Observations on the rust resistance of certain flax varieties tested at the institute of applied botany at Llavallol**).
Rev. Argent. Agron. 1938 : **5** : 25–56.
In spite of their reputation for rust resistance most varieties of La Plata are susceptible under local conditions and very few introduced varieties are at all resistant, the local physiological forms being apparently particularly virulent. A few varieties are mentioned as being immune or highly resistant. Examination of a large number of types showed that resistance was independent of flower colour, type of branching (flax or linseed), earliness, height, type of capsule, and size of seed. There are therefore great possibilities of breeding resistant varieties.

SUGAR PLANTS 633.6

1568. Carreras G., J. 633.61:001.4(85)
Los nombres locales de las variedades de caña de azúcar cultivadas en el Perú. (**The local names of the varieties of cane cultivated in Peru**).
Inf. Minist. Fom., Lima 1938 : No. 44 : Pp. 10.
Many names are synonyms and a list is given of the local names and the true identity of the varieties concerned.

1569. Aguirre, J. M. de (Jr.) 633.61:575(81)
Creação de novas variedades de canna no estado de S. Paulo. (**Production of new varieties of cane in the state of S. Paulo**).
Bol. Tech. Inst. Agron. Campinas 1936 : No. 34 : Pp. 64.
A rather exhaustive review is given of the literature of sugar cane systematics and breeding, followed by an account of the breeding work in Brazil. In the main cane area at 600–800 m. altitude flowering is irregular, though in the plains it is abundant and infallible. Crosses are made therefore in the plains while selection is carried out on the plateau. Large numbers of seedlings have been produced and the characters taken into consideration in making selections are enumerated. Forty-five selections have so far been made, comprising plants of good general aspect, health, freedom from aerial buds or roots, and from cavity in the stem, weighing over 400 grm. per m., and with over 10 per cent of saccharose in the juice. These seedlings are being grown for further selection in contiguity with P.O.J.213, the local standard, which some of them seem already to excel.

1570. 633.61:575(96.9)
An acreage census of cane varieties for the crops of 1937 and 1938.
Circ. Hawaii. Sug. Pl. Exp. Sta. 1938 : No. 71 : Pp. 59.
In the introduction very brief notes on the characteristics of five promising new seedlings are given. The major part of the circular is devoted to acreages of the different varieties in the different plantations.

1571. Gudvil, S. V. 633.63:575(47)
(Methods of breeding sugar beet at the stations of the Food Board).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 46–48.
Lysenko's theory of phasic development and vernalization has been applied to eliminate bolting in selection work. Beets with short developmental stages are more prone to bolting than long stage types. Varietal differences at different stations and the different effects of long and short vernalization on yield and sugar content are discussed and also the necessity for evolving types combining both high yield and high sugar content. Partial vernalization is also stated to be useful in rendering beets resistant to drought and for this reason too should be used in selection work.
Provisional selection by the weight of the seedlings on germination is also being studied in relation to the length of the vernalization stage and the yield and the sugar content; and it has been found that the more cold resistant strains give a considerable increase in yield following vernalization, whereas strains responding better to higher temperatures at germination show an increased sugar content.
Selection by the size of the seedlings in the field has shown similar results as regards yield and sugar content.
Experimental data are briefly analysed in the light of the relation between temperature requirements at germination and yield and regional differences in the varieties were noted.
Another means of selection used at various stations and applicable to individual plants is based on the measurement of root growth as an indication of plant growth and development.
At some centres attempts are being made to evolve varieties with seed clusters containing single seeds with a view to obtaining varieties with larger seeds and thus larger seedlings.
The production of a varietal type which will give the highest possible response to all types of manures is regarded as an important problem.
Some general observations are included on crosses of sugar and fodder beets and chard and the chemical composition of some of the hybrid forms.

1572. Mazlumov, A. L. 633.63:575(47)
(Breeding sugar beet at the Ramon Breeding Station during the last 15 years).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos. 8–9 : 42–45.
The history of the station is outlined with its aims which involve work on yield, quality (including chemical composition), earliness of maturity and rapidity of growth, resistance to bolting, etc.
The methods of breeding, selection and evaluation of the plant material at various stages and from various standpoints are described in detail. Inbreeding is not used but hybridization is, so that advantage can be taken of heterosis. Studies of plant development are being extended and elaborated.

1573. 633.63:575(47)
Orlovskii, N. I. 63.0015(47)
(The main results of breeding operations on sugar beet in the U.S.S.R.).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 11 : 51–56.
This paper outlines the development of sugar beet breeding in the U.S.S.R. from before the revolution up to the present time with remarks on the organization of existing breeding

stations and other centres where selection, seed production and other lines of research are carried on. The main aims for the breeder have been high sugar content, high yield and quality, good keeping properties, regional adaptation and disease resistance; moreover in recent years, for some regions, earliness, drought and cold resistance have been sought, while suitable root shape, uniformity in reaching maturity, low number of seeds per cluster, non-shedding and resistance to lodging are also required to meet the conditions of harvesting in the U.S.S.R.

Past defects in beet breeding methods and the remedies applied to counteract them are discussed in addition to the results of variety trials, of selection and hybridization work, of the application of vernalization and studies of phasic development in beet breeding in attaining the desired types of beet, the investigators concerned being cited throughout.

Brief reference is also made to recent genetic and cytological investigations including interspecific crossing and the hybridization of sugar beet with other cultivated beets—work in which Savitsky has been successful, though some of his results are still unpublished.

Mass and individual selection and inbreeding too are all regarded as valuable methods in beet breeding.

1574. Schneider, F. 633.63:575.127.2:632.7–1.521.6

Sur un croisement de la betterave à sucre avec *Beta procumbens*. (**On a cross between the sugar beet with *B. procumbens***).

Publ. Inst. Belge Amélior. Better. 1937 : **5** : 544–45.

B. procumbens is not attacked by nematodes, and from this cross it was hoped to obtain resistant strains of sugar beet. Most of the F_2 plants resembled the sugar beet parent. The tendency to produce seed in the first year was much greater in the hybrids than in the sugar beet. In the F_3 only 1 per cent of the plants had few or no nematodes and these are to be used for further experiments.

1575. Vilmorin, R. de 633.63:575.42

Le non-sucre en sélection. (**Non-sugars in selection**).

Publ. Inst. Belge Amélior. Better. 1937 : **5** : p. 544.

The character non-sugar is a complex of factors, it is not inherited on mendelian lines but is influenced by the environment. For a determination of the constituents of the character long and delicate methods of analysis are needed which are hardly suitable for the work of selection. The opinion on the subject is sought of sugar manufacturers and those working on selection.

1576. 633.63:581.162.31.036.5:578.08

Haretschko-Sawizkaja, E. 633.63:575.14

Eine Methode der Samengewinnung bei Selbstbestäubung autosteriler Rübensorten. (**A method of seed production in self-pollination of self-sterile beet varieties**).

C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 471–76.

It is claimed that with self-sterile sugar beets kept at 10–13° C. during flower-bud and flower formation, high sets of seed could be obtained by self-pollination. It is believed that the low temperature hinders the production of the substances which slow down pollen tube growth.

The importance for breeding work of the inbreeding thus made possible is discussed.

1577. Burström, H. 633.63:581.192:575

Zur Physiologie der Eigenschaft "Na-Sperre" der Zuckerrübe. (**On the physiology of the character "Na-block" of the sugar beet**).

Ann. Agric. Coll. Sweden 1938 : **5** : 89–104.

In some unpublished work Dr Tjebbes has demonstrated the inheritance of a low Na content combined with high K and sugar content. In the present paper the author investigates the physiology of the so called "Na-block". It was found that in the plants with an "Na-block" the Na was held in the leaves and there was a higher K (and Ca) content in the root.

1578. Shelekhov, N. N. and
Sevastianov, S. P. 633.63:581.192:575
(On the correlative variability of harmful nitrogen).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1937 : **14** : No. 3 : 59–71.

A study of the relations of sugar content and noxious nitrogen in varieties of sugar beet has lead the author to believe that it should not be difficult to breed strains with a high sugar and low nitrogen content. Data in support of this view are cited from the regional beet trials at the 1st May Station where selection for the desired combination above mentioned was apparently effective.

STIMULANTS 633.7

1579. 633.71:575(92.2)
*Schweizer, J. 633.71–2.411.4–1.521.6
Jaarverslag tabak Juli 1936 t/m Juni 1937. **(Annual report on tobacco from July 1936–June 1937 inclusive).**
Meded. Besoek. Proefst. 1937 : No. 57 : Pp. 46.

Particulars are given of the continued trials of Kedoe Nos 103 and 303 at various centres and in most instances with other strains. In general the tests with these two numbers show that in choosing a Kedoe strain the district in which it is to be grown must be taken into account. Kedoe 103 gives good results except when the rainfall is excessive. The performance of Kedoe 303 in many districts was satisfactory both as regards leaf colour and burning properties, though Kedoe 103 proved superior in some tests. In most cases No. 303 yielded a higher percentage of leaves of prime length than any of the other strains tested. Both numbers are promising as regards the brown colour of the mature leaf.

Comparative tests with the Kedoe hybrids were continued with lines I, II and III of the hybrid No. 345 and with crosses between the old hybrid 238 and Kedoe, but results with No. 345 were disappointing and the work with these numbers may be discontinued.

The trials made for some years past now show that the results with the Deli hybrids are very uniform as compared with the Kedoe lines. The hybrids Nos 344 and 362 were constantly best in the 1936–37 tests.

Selection for wrapper types has been begun and two methods are being used. In the first place an attempt is being made at Djember to improve the hybrid No. 344 which has already shown it can produce a very nice type of sand leaf. No. 344 is being crossed with types like Kanari and Grahagan Kedoe lacking the less desirable wrapper characteristics as regards the veining of the leaf. On the same basis new crosses (now at the F_2 stage) are being made with Kedoe No. 70 as female parent and various finer Deli lines as pollinators. Over 2,000 new mother plants have been retained this year, among which many appear very promising as regards both leaf and veining, though the desired type of the latter feature has very rarely appeared in plants that have retained the other characteristics of hybrid No. 344.

In the second place selection of the older pure Deli lines was taken up again at Soekoredjo Kidoel, but conditions were unfavourable and the resulting crops were inferior to hybrid No. 344 and these experiments will probably be discontinued in favour of the investigations at Djember.

In burning tests with Kedoe 103, L.M.S.A. Kedoe (bulked) and hybrid 344, Kedoe 103 showed a slightly longer burning period than the control, but it seems improbable that further selection can effect any considerable improvement in this pure bred line. Similarly, from the standpoint of their practical value the differences obtained were very slight in the burning tests with the L.M.S.A. Kedoe. Lines of hybrid 344 selected as promising from the previous year's data gave actually poor results.

Selection of the "pre-harvest" types that had originated from the cross Pajacombo x Virginia and (Pajac. x Virg.) x Albino Virginia was continued. Neither appears suitable for flue-curing. The Joyner type is still the best of the pure Virginia types.

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* An extended summary of this paper is on file at the Bureau.

In a test of Kedoe (103) and hybrids Nos 238 and 348 for resistance to *Phytophthora nicotianae* Kedoe (103) proved definitely more resistant in the year in question than the hybrids, possibly owing to its much more rapid growth and lignification which resulted in its flowering three weeks before the hybrids.
Crosses were made between Connecticut Shade Tobacco, which is said to be resistant to root rot caused by *Thielaviopsis*, and Nos 238 and 343; this material with Kedoe and some Timor tobaccos is to be used in selecting for resistance to root rot.
The programme of future research is outlined.

1580. Benincasa, M. 633.71:575.127.2
Un tabacco arboreo (*Nicotiana glauca* x *Nicotiana colossea*). [**An arboreal tobacco (*N. glauca* x *N. colossea*)**].
Boll. Tec. Tab. 1937 : **34** : 117–18.
A hybrid of *N. glauca* x *N. colossea* is described. At a year old the plant is about 7 metres high and the circumference at the base of the stem measures 30 cm. The morphological characters are intermediate and the hybrid is sterile.

1581. 633.71:575.127.5:575.129
Kostoff, D. 633.71:576.356.5
Studies on polyploid plants. XVIII. Cytogenetic studies on *Nicotiana silvestris* x *N. tomentosiformis* hybrids and amphidiploids and their bearings on the problem of the origin of *N. Tabacum*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 459–62. Also Bul. Cultiv. Ferment. Tutun. 1938 : **27** : 164–67.
An amphidiploid *N. silvestris* x *N. tomentosiformis* has been produced by back-crossing the F_1 with *N. silvestris* and then with *N. tomentosiformis*. The amphidiploid resembles *N. Tabacum*, with which it gives a fertile hybrid, thus supporting Clausen's hypothesis of the origin of tobacco.
The F_1 hybrid *silvestris* x *tomentosiformis* produces from 0 to 5 bivalents; the amphidiploid usually has 24 bivalents but produced occasional univalents and multivalents and does not breed absolutely true.

1582. Tollenaar, D. 633.71:575.243:576.356:537.531
Untersuchungen über Mutation bei Tabak II. Einige künstlich erzeugte Chromosom-Mutanten. (**Investigations on mutation in tobacco II. Some artificially induced chromosome mutants**).
Genetica 1938 : **20** : 285–94.
A further report on the X-ray induced mutations obtained by the author.
A mutant *oligofolia*, with fewer leaves than the parent line, is considered to be the result of a change intermediate between gene and chromosome mutation, for though the character is inherited as a simple recessive, lagging is to be observed at the first anaphase of meiosis. Another mutant, *lancifolia*, is monosomic and has a large proportion of bad pollen. The breeding results indicate that deficient egg cells are functional but deficient pollen grains function only rarely. One chromosome consistently lagged at second anaphase; it was not the univalent for it occurred in both second divisions of the same pollen mother cell. In the normal plants recovered from the *lancifolia* mutant this same phenomenon was observed.
The mutant *A-chlorina* on selfing gave *A-chlorina*, *D-chlorina* and normal. *A-chlorina* was found to be trisomic and *D-chlorina* tetrasomic.
Discussing the practical application of induced mutations, the author mentions that one of the *chlorina* mutants is being cultivated on a large scale on account of its bright leaf.

1583. Ivanov, M. A. 633.71:576.356.52
Experimental production of haploids in *Nicotiana rustica* L. (and a discussion of haploidy in flowering plants).
Genetica 1938 : **20** : 295–397.
Four possible methods of producing haploids were tested on *N. rustica*, (n = 24) namely, puncturing the ovary with a needle, removing the style at varying intervals after pollination,

pollinating by other genera of the *Solanaceae* and pollinating with X-ray irradiated pollen. Only the last method was successful, four haploids being obtained when the X-ray dosage was of the order required to sterilize the pollen. The effect of the X-ray treatment on the pollen and the progeny obtained is described at some length.
The haploid plants showed the usual characteristics of haploids and had irregularities at meiosis resulting from the almost complete failure of bivalent formation. Only about 1 per cent of the pollen mother cells had a single bivalent. They produced 2·5 to 3 per cent of viable pollen, but no seeds were obtained by using their pollen for selfing or for pollinating normal diploids. Seeds were obtained from the haploids by open pollination, giving mainly diploid plants and some polyploids, and by crossing with *N. Langsdorffii* (n = 9) and *N. paniculata* (n = 12). The seeds from the former cross were inviable, those from the latter gave plants showing $12_{II} + 12_{I}$ at meiosis.
In the root tips of the haploids about 2·5 per cent of the metaphase plates had the diploid chromosome number.
Meiosis in the ovule was similar to that in the anthers and most of the megaspores were inviable. The few embryo sacs formed develop normally.
The literature on haploidy in flowering plants is reviewed and a classification of haploids based on their meiotic behaviour is proposed. An appendix gives information in tabular form on the cases of haploid flowering plants so far reported.

1584. TROTTER, A. 633.71:582:575
La *Nicotiana tomentosa* Ruiz et Pavon (*N. colossea* André) e le altre specie arborescenti del genere *Nicotiana*. [***N. tomentosa* Ruiz et Pavon (*N. colossea* André) and the other arborescent species of the genus *Nicotiana*].
Boll. Tec. Tab. 1937 : **34** : 241–48.
The systematic history of *N. tomentosa* and its synonymity with *N. colossea* and *Lehmannia tomentosa* are described and the relationship with other arborescent species is discussed. The probable genetical relationship with *N. Tabacum* is noted.

1585. 633.73:576.356.5:576.354
KRUG, C. A. 633.73:575.127.2
Observações cytologicas em *Coffea* III. (**Cytological observations on *Coffea* III**).
Bol. Tech. Inst. Agron. Campinas 1937 : No. 27 : Pp. 19.
The majority of the species with large leaves are diploid (2n = 22). *C. arabica* is tetraploid (2n = 44), and has regular meiosis, with the exception of the *bullata* types, which are hexaploid and octoploid. The latter occur frequently in progenies of normal tetraploids. Since they are more common than the hexaploids they are thought to originate by somatic duplication. Meiosis was almost invariably irregular in the octoploids, univalents, bivalents and trivalents being of frequent occurrence and the separation to the poles irregular. The homeotypic division was also abnormal. The number of microspores varied from 2 to 8 and the pollen grains were very variable in size and were low in germinating capacity. An examination of megasporogenesis indicated that this was equally irregular and 29 per cent of the ovules degenerated completely, as shown by the number of abortive seeds. Many more seeds were imperfect. Several hundred seeds of normal appearance, some obtained by artificial self-pollination, were sown but germinated very badly. All but two were of the normal *C. arabica* type and had 44 chromosomes; one was octoploid and the other hexaploid. By pollination of 167 octoploid flowers with normal tetraploids only 26 fruits were produced containing only one seed, which was imperfect and did not germinate. Seventy normal flowers were pollinated with the octoploids and produced 19 fruits, with 12 seeds, of which only 7 germinated. All produced plants identical with the mother plant and containing 2n = 44, indicating that the *bullata* plants often produce gametes with 22 chromosomes, unless the plants were of parthogenetic origin. No seeds were obtained by intercrossing two octoploid plants.

It is not uncommon for the octoploid plants to give rise to tetraploid shoots by somatic mutation as well as the reverse process of somatic duplication from tetraploid to octoploid. The tetraploid shoots on *bullata* plants are identical with the normal plants, showing that the chromosomes have separated into two equal groups.

The hexaploid *bullata* plants occurring in the progeny of the octoploids are cytologically stable. Morphologically they show all the features characteristic of the octoploids but in a reduced degree. In some meioses complete asynapsis is observed, in others varying numbers of univalents, bivalents and trivalents, leading to daughter cells containing from 26 to 41 chromosomes; 33 was the most common. Micronuclei were occasionally formed. The homeotypic division was normal. The number of microspores per pollen mother cell varied from 3 to 8 and the pollen germination was only 35 per cent. The divisions of the megaspore mother cell seemed to be equally irregular. The proportion of normal seeds was low and these were of very inferior germinating capacity. Of the resulting plants examined cytologically three had 66 chromosomes and one had 44. It is clear therefore that most of the functional gametes had 33 chromosomes.

Reciprocal crosses were made between *C. arabica* (2n = 44) and the diploid species *C. canephora* (2n = 22) but very few seeds were produced and only one hybrid plant developed. This was triploid (2n = 33) but grew extremely slowly and has not yet flowered. In somatic divisions it was possible, however, to distinguish the chromosomes of *C. canephora* by their greater length.

1586. Teixeira Mendes, J. E. 633.73—1.541
A enxertia do cafeeiro I. (**Grafting coffee I**).
Bol. Tecn. Inst. Agron. Campinas 1938 : No. 39 : Pp. 18.

The importance of grafting is pointed out in relation to the collecting of species and forms for breeding purposes, especially in the case of forms of low fertility, somatic mutants, etc., for genetical work, and in particular in crossing forms that could not otherwise be crossed and for maintaining the hybrids. The author's experiments on grafting are described and practical hints on the subject are given. No difficulty was experienced in grafting forms of different chromosome number.

1587. 633.74.00.15(81)
Instituto de Cacau da Bahia. (**The Bahia Cocoa Institute**).
Illus.

The activities and organization of the institute are described in this brochure. The Technical Department is centred at the General Experiment Station in Agua Preta and a sub-station is maintained in Almada. The work of this Department includes the introduction of new forms of cacao.

AROMATIC PLANTS 633.8

1588. Miller, J. C. and
Fineman, Z. M. 633.842:575.11
A genetic study of some qualitative and quantitative characters of the genus *Capsicum*.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 544–50.

The pepper types Tabasco, Sport Cayenne and Bell were found to give fertile F_1 hybrids with each other and it is considered that the pepper types and varieties belong to one species, *Capsicum frutescens*. The genetic analysis of the cross Sport x World Beater is given. Sport has small, erect fruit, World Beater large pendent fruits; the F_1 was intermediate and in F_2 segregation into 3 pendent : 1 erect was found, the heterozygotes, however, being variable. Sport has a non-bulged, World Beater a bulged fruit base. The F_1 was intermediate and in F_2 3 bulged to 1 non-bulged were obtained. The two-loculed fruit of Sport has a pointed apex, the three or four-loculed fruit of World Beater a blunt apex. In F_1 the two and three-loculed fruits had a pointed apex, the four-loculed fruits were blunt, while in F_2 there was a poor fit to a ratio of 3 pointed and partially pointed to 1 blunt. The calyx of Sport encloses the fruit base, that of World Beater does not; the latter type is a simple dominant. The

flavour of the ovary wall of World Beater is mild, that of Sport pungent. The F_1 was intermediate but in F_2 a segregation into 3 mild : 1 pungent was obtained. It is suggested that under cool autumn conditions mildness is dominant.
The independence of the different pairs of characters was tested and though some bad fits to 9 : 3 : 3 : 1 ratios were found the only case of linkage was between type of fruit base (bulged or non-bulged) and type of calyx (enclosing or non-closing). These were linked with 4·7 per cent crossing over.

1589. Boza B., T. 633.842–2.484–1.521.6:575.42
La selección como medio de lucha contra la marchitez del Ají. (**Selection as a method of controlling wilt in chillies**).
Inf. Minist. Fom., Lima 1938 : No. 43 : Pp. 9.
Reference is made to the success achieved in selecting strains resistant to *Fusarium* wilt in other plants and in the belief that they would be equally applicable to chillies the methods are described.

1590. 633.854.54:576.356.5:581.036.1
Lutkov, A. N. 633.52:576.356.5:581.036.1
Tetraploidy in *Linum* induced by high-temperature treatment of the zygote.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 87–90.
Embryological studies showed that fertilization takes place 30 to 33 hours after pollination. A tetraploid plant (2n = 64) was obtained from the Moroccan strain K.302 of *L. usitatissimum* L. ssp. *mediterraneum* Va. and Ell. (2n = 32) by treating the parent plant at 46° C. for 1 hour beginning 33 hours after pollination. The tetraploid had larger pollen grains, with some aborted grains and larger flowers. Some chimerical plants, part diploid and part tetraploid were also found and passing reference is made to a haploid plant produced by temperature treatment.

1591. Bolliger, R. 633.854.56:665.3:578.081
Methodo rapido para a dosagem do oleo nas sementes oleaginosas (Tung e Mamona). [**Rapid method of estimating the oil in portions of oil seeds (tung and castor)**].
Rev. Agric., S. Paulo 1938 : **13** : 59–68.
The method consists in triturating the seeds, previously dried, with a fixed quantity of aviation spirit or 96° spirit and estimating the oil content by weighing the oil after evaporation of the spirit.

1592. Scheibe, A. 633.854.78:575
Zuchtprobleme bei der Sonnenblume. (**Sunflower breeding problems**).
Züchter 1938 : **10** : 126–32.
The sunflower seed available is a very mixed collection from which single stemmed strains with only one flower head should be selected. The most promising seed for this purpose is of Turkish origin.
The seeds vary considerably in size, thousand grain weight and in the proportion of husk. For Germany small seeded forms are needed, with a medium thousand corn weight and a low proportion of husk.
Breeding work with the Anatolian forms of sunflower produced groups and families with varying thousand grain weight and fat content and the results for three of these groups are given in tabulated form. These show that it is possible to breed forms with relatively low thousand grain weight but with a satisfactory fat content. The protein content is inversely proportional to the fat content and is independent of the thousand grain weight.
Investigations also show how variable is the proportion of fat and protein in the different strains.

1593. Morozov, V. K. 633.854.78:575:665.3
(Breeding sunflower for high oil and low husk).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 10 : 23–24.

The standard varieties have 51–54 per cent of oil in the kernel and 39–42 per cent of husk. Occasional plants in the variety No. 169 have been found with a husk percentage below 38·2 per cent and an oil content above 60 per cent. Observations on a large number of plants have shown that low husk percentage and high oil content are not negatively correlated, and can both apparently be combined with high yield.

Experience in hybridization has shown that those combinations which in the first generation are promising with regard to oil content generally continue to be so in the later generations; the same applies to husk percentage. Selection for these characters in the F_1 is therefore recommended, except in cases where the F_1 is intermediate, in which case desirable types may appear in later generations.

1594. Marčenko, I. I. 633.854.78:575.127.2:635.24
(The problem of the cultivation of a perennial and tuber bearing sunflower).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 29–32.

The author's object was to utilize the characters of wild types of *Helianthus* to obtain a new perennial type with perennial rhizomes and possibly also a tuber-bearing sunflower equalling *H. annuus* in seed production. Resistance to *Orobanche* was also kept in view.

Direct and reciprocal crosses were made of *H. annuus* with the three tuber-bearing species *H. tuberosus*, *H. subcanescens* and *H. macrophyllus* respectively and various distinctive features and the relative fertility of the hybrid generation obtained are mentioned, with some cytological findings on the fertile hybrids from the cross between *H. subcanescens* and the sunflower. Heterosis was observed in the crosses with *H. subcanescens* and with *H. macrophyllus* when *H. annuus* was the male parent.

The most successful cross was with *H. subcanescens* while *H. macrophyllus* gave poor results and *H. tuberosus* was least successful, especially when the sunflower was used as the maternal parent. This is regarded as supporting the view that crosses between plants with different chromosome numbers are more successful when the maternal parent has the larger chromosome complement.

The most promising hybrids from the standpoint of earliness, productivity, compactness and quality of the tubers were those from the cross between *H. annuus* and *H. subcanescens*. Segregation occurred in the F_2 for perennial and annual habit.

None of the hybrids was infected by rust, *Orobanche* or *Sclerotinia*.

RUBBER PLANTS 633.91

1595. Afanasiev, C. S. 633.913
A new valuable rubber plant from Pamiro-Alai.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 479–82.

The new rubber-yielding plant found on the northern slopes of the Turkestan mountains, at an altitude of 1900–2100 m., is closely related to tau-saghyz and has been named *Scorzonera kirghisorum*. The average rubber content is about 7 per cent.

FRUIT TREES 634

1596. Alderman, W. H. 634.00.14:575(77.6)
Pre-introduction testing of new fruit varieties.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 1–4.

Since only about 50 of the 750 varieties of fruit introduced by fruit-breeding stations in the U.S.A. and Canada have succeeded in establishing themselves, it appears that more stringent tests are needed before new varieties are introduced. The plan adopted by the University

of Minnesota Fruit Breeding Farm is outlined; it includes two tests in the Farm and one co-operative test (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 1303).
The time from the making of a cross to the completion of the third test ranges from 10 or 12 years for small fruits to 20 or 25 years for tree fruits.

1597. Fischer, A. and
Schmidt, M. 634.1/2:576.16:575
Wilde Kern- und Steinobstarten, ihre Heimat und ihre Bedeutung für die Entstehung der Kultursorten und die Züchtung. (**Wild species of pome and stone fruit, their homeland and their importance for the origin of cultivated varieties and for breeding**).
Züchter 1938 : **10** : 157–67.

A survey of the wild species of apple, pear, quince, cherry, plum, peach and almond, their distribution and their importance and problems in the breeding of improved varieties. Much of the work reported has already been reviewed in "Plant Breeding Abstracts".

1598. Gould, H. P. 634.11:575(73)
Notes on some apple crosses.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 5–8.

Brief descriptions are given of the progenies of the following crosses, with remarks on fruit appearance and quality and incidence of disease: Winesap x McIntosh, Winesap x Granny Smith, Winesap x Keeper, McIntosh x Granny Smith and reciprocal, Yellow Newtown x Granny Smith, Yellow Newtown x Vandevere, Yellow Newtown x McIntosh and Cox's Orange x Yellow Newtown.
The Winesap–McIntosh cross was promising in appearance of the progeny, size, colour, eating quality and relative freedom from disease. Granny Smith and Vandevere produced many unattractive offspring, with a high percentage susceptible to disease. Cox's Orange x Yellow Newtown gave progeny with exceptionally good dessert quality but otherwise unattractive.
The progenies were grown near Beltsville, Maryland.

1599. Dorsey, M. J. 634.11:575(77.3)
Place of fruit breeding in horticultural development.
Trans. Ill. Hort. Soc. 1937 : **71** : 285–89.

In the apple breeding project at the University of Illinois parents are chosen with high quality, red fruit, hardiness, firmness of flesh, productiveness and disease resistance. Nearly 50,000 seedlings have been raised in the past 30 years and some 300 seedlings are now under observation. It is hoped to get an apple variety for the northern section of the state from the cross between McIntosh and Akin.

1600. 634.11:575.127.5:634.13:581.331.23
Tatarintzeff, A. S. 634.711:575.127.5:634.75
(**Pollen germination on the stigma in some intergeneric crosses**).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I.V. Michurin) 1937 : No. 4 : 18–23.

A study of pollen germination in reciprocal crosses (1) between apples and pears, and (2) between raspberries (the Marlborough and Turner varieties) and various types of strawberries (including *Fragaria elatior*). With the apples and pears germination was equally successful in interspecific and intergeneric crosses. Moreover in the intergeneric crosses no delay in germination need necessarily occur. Successful results were also obtained in some of the raspberry and strawberry crosses; but in others a considerable reduction in the percentage germination was recorded and it is therefore recommended that in such crosses measures should be taken to provide a suitable environment for the pollen, such as the transference of portions of the stigma of the male parent to the stigma of the female parent.

1601. 634.11:575.252.061.6
TOENJES, W. 634.11 Red Gravenstein
Red Gravenstein. New apple variety recommended for trial planting in Michigan.
Quart. Bull. Mich. Agric. Exp. Sta. 1938 : **20** : 228–29.
A brief description is given of this red sport of the Gravenstein variety.

1602. EDGECOMBE, S. W. 634.11:576.356.5
Abnormalities in the seedlings of certain apple stocks as associated with triploid chromosome numbers.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 402–08.
Virginia Crab, Hibernal and Stayman have irregular meiosis and are triploids; Whitney, Ames 550, Anisim, Starking, Delicious, King David, Jonathan and Grimes are diploid and have regular meiosis. Seedlings of Stayman were found to be aneuploid. The triploids are of little use in breeding work.

1603. HOWLETT, F. S. 634.11:581.331.1:576.356.5
Factors affecting the rate and course of development of the female gametophyte in apple varieties.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 105–10.
Subsequent to the megaspore stage more embryo sacs degenerate in triploid varieties than in diploid; there are also marked differences within these groups. In the triploid Arkansas, more embryo sacs degenerate in the terminal than in the lateral flowers. Embryo sacs in triploids develop more slowly in relation to anthesis than in diploids and are more susceptible to environmental factors.

1604. TUCKER, L. R. 634.11:581.47:581.481
Relation between number of carpels and number of cotyledons of the apple.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 9–11.
The apple varieties Delicious, Golden Delicious and Rome produce some fruits with more than the normal five carpels and in such fruits seeds with more than two cotyledons are more frequent than in normal fruits.

1605. 634.12:575(78·4)
BOLLES, C. 634.12 Red River
The Red River crab.
Ctry Gent. 1938 : **108** : p. 82.
The Red River crab has been produced by A. F. Yeager of the North Dakota Experiment Station from a cross between the Delicious apple and the Dolgo crab.

1606. ADATI, S. 634.13:576.312.35:576.356.5
(On the chromosome number of the cultured pear).
Bot. and Zool. 1935 : **3** : 1445–50.
The chromosome number of 32 varieties of pear cultivated in Japan was found to be n = 17, which is also regarded as the haploid number for all the genera of the *Pomoideae*. No triploids were found in the experimental material, which included the varieties Tosa-Nisiki and Tyozuro. The former variety, however, and New Tyozuro have been regarded as tetraploids by Ito and Fukushima.
One variety, Mukaku-Ri, is seedless and has very small fruits. Chromosome behaviour in the pollen mother cells is normal and the sterility appears to be from the female side.
The views of Sax, Moffett and Darlington on the genom analysis of the *Pomoideae* are considered. The author concludes from his investigations that the 17 chromosomes of this botanical group should be interpreted as indicating allopolyploidy, arising by the doubling of basic numbers 8 and 9 in hybrids.
A list of pear varieties with their chromosome numbers is given.

1607. 634.2:575.127.2:581.331.23:537.5
KARPATCHEFF, V. S. 634.711:575.127.5:634.75:581.331.23
(The limits of crossability should be widened).
Za Mičurinskoe Plodovodstvo (Horticulture by Michurin's methods. Bull. Lenin Acad. Agric., Sci. Res. Inst. Fruit Grow. I.V. Michurin) 1937 : No. 4 : 33–36.

The effect of using pollen subjected to varying doses of X-rays, ultra-violet rays, ultra-short wireless waves and ionization was studied in crosses of *Prunus Besseyi* x *P. triflora*, *Rubus idaeus* x *Fragaria vesca* and its reciprocal. X-rays and ionization produced a marked increase in the set obtained, ionization being specially effective with *P. triflora* pollen, the number of hybrids obtained being almost double as compared with the controls. The energy of germination of the hybrid seed was also greatly increased. The question of the optimum length of exposure to ionization is discussed.

Laboratory experiments also carried out showed that the most important factors promoting pollen germination were an adequate supply of moisture and sufficiently dense sowing of the grains. In general the denser the sowing the better was the germination; but different species differ in the degree of reaction.

Tests of the influence of different doses of ultra-violet rays on the pollen showed that both the length of the pollen tubes and the percentage of germination were increased by such treatment, though repeat tests were not successful.

1608. 634.21–2.111–1.521.6
BOLLES, C. 634.21 Scout
The Scout apricot.
Ctry Gent. 1938 : **108** : p. 82.

This new hardy apricot has been produced by the Morden Experiment Station, Manitoba from seed sent by the Chinese Eastern Railway.

1609. FLORY, W. S. 634.22:575.127.2:581.162.5
Cross sterility in hybrid plum varieties.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 43–46.

In an extensive crossing programme at the Texas Agricultural Experiment Station cross sterility was found in the following groups:—(*a*) the different *Prunus salicina* hybrids; (*b*) *P. hortulana* and *P. salicina* hybrids; (*c*) *P. salicina* and the *P. salicina* hybrids.

1610. 634.22:575.129:581.192
LEVINA, E. D. 634.22:575.127.2
On chemico-genetic study of the plum.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **19** : 83–86.

In respect of sugar content (including sucrose percentage), acidity (including citric acid content) and tannin content, the cultivated plum, *Prunus domestica* and *P. insititia* combine the characteristics of *P. spinosa* and *P. cerasifera*, thus supporting the hypothesis of Crane and Lawrence (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1363).

1611. 634.25:575
634.25:581.45:575.11.061.6
BLAKE, M. A. 634.25:575"793"
Progress in peach breeding.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 49–53.

The classes of fruit flesh now recognized are soft melting, firm melting, non-melting and semi-melting.

Several peaches with red leaves are in the collection of the New Jersey Experiment Station. This character appears to be due to a single factor and the heterozygote is intermediate. It does not affect the colour of the flesh of the fruit.

Data are given on the date of ripening of the F_1 progeny from several crosses. They are not always midway between the parents in this respect. Some crosses show transgression for earliness, others for lateness. In several there was a tendency for the progeny to fall into two groups. Certain qualitative characters were sometimes associated with date of ripening.

1612. Dorsey, M. J. 634.25:575(77.3)
Peach breeding project.
Trans. Ill. Hort. Soc. 1937 : **71** : 386–92.

From the early peach breeding work at the University of Illinois no seedlings worth introducing were obtained and in the later work different parents have been used. The objectives are hardiness, firmness of flesh, yellow flesh and free stone. Two promising seedlings have been obtained from the cross J. H. Hale x Elberta.

1613. Upshall, W. H. 634.25:575.252
Some unusual bud sports of the peach.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 47–48.

The following bud sports are briefly described:—Fisher, a mutant of the Valiant variety, which it resembles in all respects except in ripening about three weeks earlier; Large Flowered Elberta, a mutant of Elberta with large flowers but otherwise indistinguishable from the parent variety; Vedette sport, two weeks earlier than Vedette, the parent variety, and clingstone instead of freestone like Vedette.

1614. 634.25:581.331.2:576.356.5
Dermen, H. 634.21:581.331.2:576.356.5
Detection of polyploidy by pollen-grain size. I. Investigations with peaches and apricots.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 96–103.

Large grains occurring in the pollen of peach and apricot varieties are believed to be diploid. The percentages of these and of abortive grains occurring in numerous peach and three apricot varieties are given. Environmental as well as varietal differences were noted.

CITRUS FRUITS 634.3

1615. Nakamura, M. 634.3:576.312.35:576.16
(Cytological studies in the genus *Citrus*. II. The chromosome number, pollen sterility and the formation of abnormal pollen tetrads).
Studia Citrol. 1934 : **6** : 162–78.

Examination of the pollen mother cells of numerous species of *Citrus* comprising 94 forms revealed 2n = 18 as the chromosome number in all except the Shikinarimikan strain (*C. microcarpa*), which is a tetraploid and has larger and sweeter fruits, thicker leaves and larger pollen grains than the diploid forms of the species. About 30 per cent of its pollen is imperfect.

The Thomasville Citrangequat, derived from the cross *Fortunella* x *Citrus* x *Poncirus* showed marked affinity between the chromosomes at metaphase I and this fact with the evidence from pollination and breeding experiments by other workers has led the author to the conclusion that these three genera contain the same genom and that the evolution of species within the genera is mainly due to the formation of new allelomorphs.

Various aberrations in pollen formation are noted in the limes, lemon, sweet orange and other groups. The high percentage of sterility in many varieties is attributed mainly to a lethal factor resulting from hybridization or gene mutation.

The influence of climatic factors in inducing seasonal sterility was also noted in the lemon and the sweet lemon.

Meiotic figures suggestive of secondary pairing were observed in many varieties but the possibility of this configuration being an artefact cannot be excluded.

VARIOUS SMALL FRUITS 634.4

1616. 634.418(75.4 + 79·7)
SHOSTECK, R. 634.418 McWhorter
Now we have paw-paws.
Northw. Fruit Gr. 1938 : **10** : p. 7.
A pawpaw (*Asimina*) from the West Virginia mountains has been found suited to the Pacific Northwest climate. It has been named the McWhorter pawpaw.

NUTS 634.5

1617. COLBY, A. S. 634.521:575(77·3)
Some results of selection in the northern pecan.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 88–90.
As a result of pecan contests held in Gallatin County, Illinois, three promising seedlings have been discovered, Goforth, Gallatin and Duley.

1618. BEAUMONT, J. H. 634.57:575.42(96.9)
The evaluation of certain nut characters used in selecting varieties of macadamia.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 235–37.
Macadamia nuts are propagated as seedlings in Hawaii and show great variability. A selection of 313 trees was made and from these a further selection of 39 trees. Samples of the nuts of these two sets of selections were compared with a random sample of nuts. The means and standard errors of the diameter of the nut, weight of kernel, thickness of shell at the side and thickness of shell at the base are given. These data do not indicate any improvement due to selection. When the regression of these characters on each other in the random sample and in the two selected samples is considered, however, it appears that the selected nuts have thinner and more uniform shells for a given diameter of nut.

PALMACEOUS AND OTHER FRUITS 634.6

1619. 634.651:581.46:581.47
STOREY, W. B. 634.651:577.8
The primary flower types of papaya and the fruit types that develop from them.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 80–82.

STOREY, W. B.
Segregations of sex types in Solo papaya and their application to the selection of seed.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 83–85.
Five types of flower are recognized in the papaya. Type I is pistillate, Type V staminate and Types II, III and IV hermaphrodite. The pistillate flowers produce spherical fruits and the hermaphrodite flowers produce more elongated fruits; those of Type III are usually misshapen. An intermediate pyriform fruit is preferred by the market.
The inheritance of these sex types has not been fully elucidated but it has been shown that ♀ x ♂ gives equal numbers of ♀♀ and ♂♂, ♀ x ☿ (Type IV) gives 1 ♀ : 1 ☿ : 0 ♂, ♂ selfed (the staminate trees produce occasional perfect flowers) gives 1 ☿ : 2 ♂♂ and ☿ (Type IV) selfed gives 1 ☿ : 2 ☿☿ : 0·05 ♂. For commercial seed production the last type of pollination is the best since it gives almost exclusively productive types; the occasional staminate tree is useful for pollination purposes.

1620. Andreičenko, D. A. 634.7–1.524.4(57)
(Let us utilize the many wild bush fruits of eastern Siberia).
Plodoovoščnoe Khozjaistvo (Fruit and Vegetable Growing) 1938 : No. 3 : 56–62.

Various species of *Ribes* have been found and are described and illustrated, with indications of their practical characteristics such as yield, fruit size, flavour, disease resistance, and time of maturity. The unusually frost-resistant species *R. dikuscha*, which gives high yields of large fruit, is of particular interest as a parent in breeding.
Certain forms of *Rubus idaeus* subsp. *vulgatus* combine frost resistance with high yield, size of fruit, and good flavour; the subspecies *melanosius* is low in quality but exceptionally frost-resistant and is in this respect promising as a parent.
The various species of *Vaccinium* found are described, with indications of their practical value.
An extensive breeding programme making use of these wild forms is being inaugurated.

1621. Rozanova, M. A. 634.71:575.129:576.356.5
On polymorphic type of species' origin.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 677–80.

Mechanisms whereby polyploid species of hybrid origin may be polymorphic from the first are suggested and illustrated with reference to the author's work on *Rubus* (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 261).

1622. Stene, A. E. and Odland, T. E. 634.715:581.49:575.11
Inheritance of thorns in blackberries.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 54–56.

Most of the so-called thornless varieties are only partially free from thorns. The only completely thornless varieties grown at Rhode Island Agricultural Experiment Station are Austin Thornless (Mayes Thornless) and Santa Rosa (Burbank Thornless). The thornlessness of the former variety is due to a single dominant factor, carried in the heterozygous condition. All F_1 plants from crosses with Austin Thornless as a parent produced few and imperfect fruits.
Crosses involving Cory Thornless, Thornless Youngberry and *Rubus canadensis* have given plants as thorny or more so than the so-called thornless parent.

1623. Mortensen, E. and Yarnell, S. H. 634.75:575(76.4)
Breeding strawberries for Texas.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 57–59.

The main breeding objective is to increase plant production. Other special factors to be considered are ability to set fruit in short days, frost resistance and earliness. The chief varieties used for crosses in 1933 and 1934 were Missionary, Klondike, Blakemore, Banner, Excelsior, Aroma and Thomson. The results of the different crosses are discussed and data are given on the number of selections made from the 1934 crosses. Missionary has given some interesting selections when crossed with Banner, Redheart, Texas and Klondike but not with Aroma. Klondike usually gives seedlings of poor dessert quality but some good seedlings have been obtained by crossing with Blakemore and Missionary. Blakemore gave good results with Banner and Klondike; Banner with Blakemore and Missouri. At present 8 selections are being tested in various parts of the state.
For future breeding work many commercial varieties and a number of wild *Fragaria chiloensis* selections have been tested.

1624. Drain, B. D. and Fister, L. A. 634.75:575(76.8)
Some strawberry breeding progeny data.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 60–66.

Extensive data are given on fruit and plant characters and disease incidence in progenies

raised at the Tennessee Experiment Station by selfing or crossing strawberry varieties. The varieties used were Klondike, Aroma, Blakemore, Dorsett, Missionary, Premier (Howard 17) Howard Supreme, Gandy, Redheart and Fairfax, the promising parents being Missionary, Klondike, Blakemore and Premier. All parents and progenies had some defect. Leaf scorch, leaf blight and root rot were the important diseases and the strawberry root louse (*Aphis forbesi* Weed) was serious on certain progenies. With the exception of Dorsett x Aroma, Klondike x Dorsett and Dorsett x Redheart, crosses gave much more vigorous progenies than selfing.

1625. CLARK, J. H. 634.75:575.11"793"
Inheritance of the so-called everbearing tendency in the strawberry.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 67–70.

The inheritance of the everbearing character has been studied in the breeding progenies of the common garden strawberry (derived from *Fragaria chiloensis* and *F. virginiana*) raised at the New Jersey Experiment Station. Crosses between non-everbearers and everbearers gave an average of 34.02 per cent. everbearers. Crosses between everbearers gave 61·03 per cent everbearers and crosses between non-everbearers gave no everbearers. The results with the varieties N.J.1, N.J.8 and N.J.220 are not included in the above results. N.J.1, an everbearing variety gave no everbearers when selfed or crossed with non-everbearers. N.J.8, another everbearing variety gave 11.90 per cent everbearers when selfed and 8.81 per cent when crossed with non-everbearing varieties. N.J.220, a non-everbearing variety, gave 11.77 per cent everbearers when crossed with non-everbearers.

The everbearing tendency thus behaves as a dominant in most crosses but is recessive in N.J.220. No homozygous everbearing varieties were found. It is suggested that the polyploid nature of strawberries makes the inheritance of this character complex.

1626. COLLINS, J. L. and KERNS, K. R. 634.774:575.242
Mutations in the pineapple. A study of thirty inherited abnormalities in the Cayenne variety.
J. Hered. 1938 : **29** : 163–72.

Brief descriptions are given of 30 relatively conspicuous and easily recognised mutant types. They include both dominant and recessive mutations and some showing incomplete dominance relations. Some are considered progressive in nature and some occur more frequently than others.

The importance of vegetative propagation in allowing the accumulation of mutations is stressed.

VITICULTURE 634.8

1627. DALMASSO, G. 634.835:575(43)
La genetica per l'avvenire della viticoltura in Germania. (**Genetics for the future of viticulture in Germany**).
Ital. Agric. 1938 : **75** : 235–46.

The organization of the Kaiser Wilhelm Institut für Züchtungsforschung at Müncheberg is briefly described and the work and achievements of the section engaged in viticulture are discussed.

The aim is to produce the ideal vine of European origin. Already vines resistant to *Peronospora* have been bred and progeny of *Vinifera* crosses resistant though not immune to phylloxera. The problems and methods for bud selection are also mentioned. In conclusion, the importance for Italian viticulture of the German researches is discussed.

1628. WELLINGTON, R. 634.835:575"793"
The Khalili as a parent for breeding early grapes.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 76–79.

Khalili, believed to be an ancient grape grown in Western Asia, is a very early variety and when crossed with late seedlings has given a number of remarkably early seedlings of excellent

quality. Many of the resulting seedlings were susceptible to mildew and winter injury. Tabular data are given on the progenies obtained.

1629. NEGRUL, A. M. 634.835:581.9
Evolution of cultivated forms of grapes.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 585–88.
A concise account is given of the development of the different types of grapes. It is considered that the cultivated grape has its centre of origin in Asia Minor and Transcaucasia.

FORESTRY 634.9

1630. RUDOLF, P. O. 634.97:575.42
Pedigreed trees.
Minn. Conservationist 1936 : No. 37 : 4–5.
The importance of using seed of suitable provenance and from good mother trees is stressed.

1631. WETTSTEIN, W. von 634.972.3:575.125
Leistungssteigerung durch Herkunftskreuzung bei *Populus tremula*.
(**Increasing performance by crossing trees of different provenance in *P. tremula***).
Naturwissenschaften 1937 : **25** : 434–36.
P. tremula can only be propagated vegetatively by means of root suckers and this is not a very satisfactory method. Crosses between trees of *P. tremula* from Müncheberg and the Black Forest gave progeny which, compared at the end of the first year's growth with the progeny of crosses between Müncheberg trees, showed markedly increased growth in height.

VEGETABLES 635

1632. 635(73)
New vegetable varieties.
Horticulture 1938 : **16** : p. 233.
Brief notes are given on new American varieties of beans, cabbages, peas, peppers, squashes, sweet corn and tomatoes.

1633. TATEBE, T. 635.15:581.43:575.11.061.6
(**On inheritance of root colour in *Raphanus sativus* Linn.**).
Jap. J. Genet. 1938 : **14** : 39–50.
From crosses between radishes with white, red, purple, yellow and black roots respectively the following genotypes are proposed: –white, *rrBByy*; red, *RRbbyy*; purple, *RRBByy*; yellow, *rrBBYY* or *rrBbYY*; black $rrBBY^bY^b$. *R* produces red pigment dominant over *r*, its absence. *B* modifies the red to purple. Y^b, *Y* and *y* are multiple allelomorphs producing black, yellow and white respectively, with Y^b dominant over *Y* and *y* and *Y* dominant over *y*. The cross between black and purple gives a blackish purple F_1 and 9 blackish purple : 3 purple : 3 black : 1 white in F_2. Red x yellow gives a purple F_1 and 9 purple : 3 red : 3 yellow : 1 white in F_2.
Some plants of the variety Cincinnati Market were found to be heterozygous for a recessive factor *xa*, giving yellow seedlings of low viability.

1634. TATEBE, T. 635.15:581.43:575.11–181.12
(**Studies on the inheritance of root shape in the Japanese and Chinese radish**).
J. Hort. Ass. Japan 1937 : **8** : 327–36.
In crosses between long and round radishes, the F_1 root shape was intermediate and somewhat nearer the round parent. The F_2 distribution for shape index was trimodal and a single major factor for root shape giving a 1 : 2 : 1 ratio is postulated, with probably a minor modifying factor.

1635. Timofeev, N. N. 635.25:575.12"793"
(Earliness of onions for pickling).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : Nos 9–10 : 202–07.

From a study of the morphology and course of development of the late maturing ordinary onion and of the small early variety used for pickling it is suggested that the latter is merely a suspended form of the former type—an assumption supported by the phenomenon of secondary growth in the pickling onion. It is suggested that, if due consideration is given to reactions to length of day, crosses between the two types—late and early –should result in a high yielding early onion of the larger size and capable of maturing under conditions of the temperate zone in the U.S.S.R. and also further north where frost periods are short and length of day greatly prolonged.

1636. 635.25:575.127.2:635.26:575.125
Krivenko, A. 635.25:576.312
[Interspecific crosses of onion plants (*Allium* L.), I.].
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1937 : **6** : 459–78.

In 1934 crosses were made between (1) *A. cepa* and *A. fistulosum* and (2) between *A. cepa* and *A. altaicum* which produces few bulbs but is frost resistant like *A. fistulosum*. Some seed was obtained in both cases. In 1935 the hybrids of the first cross when the biennial was pollinated by the perennial form produced no bulbs but flowered in 1936. The second cross was not due to flower till 1937.

The cross *A. fistulosum* x *A. cepa* gave more seeds than its reciprocal but the latter resulted in a much higher germination percentage and an F_1 which also gave more seed, most of which resulted from pollination by *A. fistulosum*; otherwise the hybrids were intermediate between the parents in most morphological features. The flowering period was followed by a vigorous development of foliage which did not terminate till November, 1936. The cross was repeated with the two varieties of *A. cepa* which had given the highest set in the previous experiments. Five out of 27 hybrids from the *A. cepa* (variety Danilovskii) x *A. fistulosum* cross formed round bulbs which were smaller than the flatter ones of the Danilovskii parent and grew rather deep in the soil. The remaining 22 hybrids were more like *A. fistulosum*. The necks of the bulbs of the hybrids were reddish purple though paler than in the Danilovskii variety. The bulb of *A. fistulosum* is white. The hybrids of the second cross *A. cepa* (variety Troitskii) x *A. fistulosum* were similar to the 22 plants just described.

The author's results of 1936 (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1026) were confirmed as regards the number and types of the chromosomes. In contrast however to Levan's findings the chromosomes of *A. cepa* appeared somewhat larger than those of *A. fistulosum*; and the satellited chromosome was in the latter species larger than in *A. cepa*. Irregularities in meiosis were observed in the F_1. The most frequent number of univalents at metaphase I was four. In the second division lagging chromosomes and other forms of disorganization were noted.

The pollen of the hybrids, though very heterozygous, exhibited two main types: somewhat oval grains of normal dimensions and round giant grains. Data from eleven pollen grains indicated that 8 was the most frequent number of chromosomes present.

The *A. cepa* x *A. altaicum* cross proved much more difficult to make. At a second attempt in 1936 however, 33 seeds were set and the hybrids will be described in a future communication.

It is believed that the F_1 from *A. cepa* x *A. fistulosum*, which displays heterosis, has a prolonged vegetation period and is easily reproduced vegetatively, should be of practical value as a high yielding, frost resistant perennial with marked top growth. Moreover other F_1 forms with bulbs set deep in the soil should prove frost resistant and good material from which to breed the type of onion grown for its bulb. (Cf. also "Plant Breeding Abstracts", Vol. VII, Abst. 1382).

1637. Levan, A. 635.25:576.356.5:581.04
The effect of colchicine on root mitoses in *Allium*.
Hereditas, Lund 1938 : **24** : 471–86.
All mitoses occurring under the influence of colchicine in solutions of 0·01 per cent or stronger take a characteristic course, ascribed to an inactivation of the spindle apparatus associated with a delay of the division of the centromere. The result is a completion of chromosome mitosis without nuclear or cellular mitosis.
By prolonged treatment extremely high chromosome numbers, of the order of 1,000, were produced, but cells with more than about 500 did not appear to be capable of mitosis.
The practical advantages of colchicine over other agents for inducing polyploidy are its specificity and certainty.

1638. Young, R. E. 635.31:519.241.1:575.42
Yield-growth relationships in asparagus.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 576–77.
The number of stalks produced by individual plants in summer growth after the harvest season was found to be closely correlated with the number of spears produced and also with yield.
It is suggested that this might be used by seed producers in the improvement of strains. The male and female plants producing most stalks in summer growth could be planted in a seed plot.

1639. Currence, T. M. and 635.31:575:519.241.1
Richardson, A. L. 635.31–1.421:519.241.6
Asparagus breeding studies.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 554–57.
The correlations of yield and spear size in staminate and pistillate plants with a number of plant characters are given. Yield was positively correlated with number of stalks and diameter of crown of four year old plants and spear size negatively correlated with the same characters. Spear size was positively correlated with yield of seed. It was also found that the total yield of five year old plants was positively correlated with that of four year old plants.
Significant differences in yield and spear size were found between progenies raised from one pistillate plant by different staminate plants. The spear sizes of the progenies agreed better with those of their respective staminate parents than did the yields. Open pollinated progenies of different pistillate plants were replicated and randomized and the analysis of variance showed that significant differences occurred between them in respect of root weight after six months. The differences were unrelated to the yields of the parents.
The percentage standard error of plots ranging in size from 1 to 36 plants are given.

1640. Miryuta, J. P. 635.41:577.88:575.1
(A contribution to the genetics of sex in plants).
Bull. Acad. Sci. U.R.S.S., Sér. Biol. 1937 : 843–50.
The monoecious forms of *Spinacea oleracea* occurring in the world collection were classified into three groups, according to the type of flowers they bear, namely ♂, ♀ and ☿ of two kinds. These types were shown to be constant and not altered by environmental factors such as length of day, nutrition or conditions of growth.
The results of a number of crossings between the different types are tabulated and show the sex differences to be genetical in nature, all the types being markedly heterozygous. Some combinations segregated into the paternal type + ♂ plants, others into paternal type + ♀ others again into paternal type + monoecious and a fourth group reproduced the paternal type without segregation.

1641. Yamamoto, Y. 635.45:581.49:576.356.5
(The sizes of stomata in true polyploid and heteroploid sorrel).
Bot. and Zool. 1934 : **2** : 924–26.
A study of nine sorrel plants comprising polyploids ranging from 2x to 6x showed that in diploids the stomata in male plants were larger than in female plants, the stomatal width

being least in the diploid female and largest in the intersex hexaploid, and the length being smallest in the diploid female and largest in the pentaploid (sex uncertain). In general size increases with the chromosome number; an exception however is found in the pentaploids and hexaploids, the former having larger cells than the latter.
The pentaploids were obtained from the F_1 of a cross of Japanese sorrel (2x = 14,15) x European (2x = 14,15) and the F_1 showed heterosis and irregular reduction divisions. The intersex hexaploids were poorly developed and were not as tall as the intersex triploids.

1642. Babcock, E. B.,
Stebbin, G. L., Jr. and
Jenkins, J. A. 635.52:576.312.35
Chromosomes and phylogeny in some genera of the Crepidinae.
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 188–210.
Inter alia the diploid chromosome numbers of numerous species of *Lactuca* are given and their chromosome morphology briefly described. The Old World species have 2n = 16 and 18 and the American species all have 2n = 34, the latter being probably amphidiploids.

1643. Cochran, F. D. 635.63–2.411.4–1.521.6:575.11.061.6
Breeding cucumbers for resistance to downy mildew.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 541–43.
The Indian variety Bangalore is resistant or tolerant to downy mildew but is of poor quality and about 10 days later than most of the common varieties grown in the U.S.A. It was crossed with four commercial slicing and pickling varieties and the F_1, F_2 and back-cross (to the commercial varieties) generations were grown under conditions of severe infestation with downy mildew. The F_1s were intermediate between the parents in earliness and showed heterosis in vigour and yield. In the back-crosses and F_2s many segregates were as early as the commercial parents. Segregation for fruit colour and spine colour gave a ratio of 9 : 3 : 3 : 1 with green fruit dominant over white and, presumably, black spines dominant over white. The F_1s were more resistant than the commercial parents and segregation for resistance was observed in the F_2, some plants showing as much resistance as the Indian parent. Resistance seems to be determined by several factors and independently of fruit or spine colour. All plants showing high resistance have been selected for further studies.

1644. 635.64:575(79.4)
Schacht, H. 635.64 Pearson
A new shipping tomato.
Ctry Gent. 1938 : **108** : p. 70.
A brief description of the new variety Pearson developed and tested by the University of California. It is derived from a cross between Cal 55 and Fargo, and was first released in 1933 as Hybrid No. 65. It is named after the breeder.

1645. Yeager, A. F. and
Meader, E. 635.64:575:575.11
Short cuts in tomato breeding.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 539–40.
Brief descriptions are given of three cases in which simple genetics were applied to shorten the work in producing new varieties of tomatoes. The first was the production of the variety Farthest North combining the extreme earliness of the Red Currant tomato with the large fruit size and the determinate habit of Bison. The second involved a further increase in fruit size and a decrease in plant size of Farthest North by crossing it with Golden Dwarf Champion. In the third the variety Allred was crossed with Break-of-Day to improve the fruit type of the former, which is quite rough.

1646. Rubin, B. A. and
Lipman, S. P. 635.64:575:581.6:576.356.5
(The chemical composition of tomatoes in relation to breeding).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : Nos 8–9 : 52–53.

Observations on the effects of the stage or maturity upon the chemical composition of tomatoes and their acid content and the possible influence of climate and soil upon the saccharose content are followed by data on variation in the chemical composition in hybridization. Direct and reciprocal crosses indicate that the direction in which the cross is made affects the chemical composition of the fruit, which in some cases also exhibited the effects of heterosis. In some experiments doubling of the chromosome complement was accompanied by an increase in sugar content, dry matter, etc., though the influence of weather conditions and vegetation period must be regarded as playing a role in such changes.

1647. Selivanov, M. V. and
Alpat'ev, A. V. 635.64:575.125
(Heterosis in tomatoes in the canning industry).
Plodoovoščnoe Khozjaistvo (Fruit and Vegetable Growing) 1938 : No. 1 : 21–24.

Thirty-five parental combinations were tested. All were earlier in maturity than either parent; 11 exceeded the better parent in yield by 20–51 per cent, 10 by 10–20 per cent and the rest were slightly superior or equal to the better parent. Heterosis was most pronounced in crosses of varieties differing in type. The hybrids were better developed and more disease resistant than the parents. They produce a greater proportion of their yield in July, which is a month in which the supplies for canning are greatly below the demand. In fruit quality the hybrids are equal to the standard varieties. The use of hybrid seeds in the collective farms in recommended and the most favourable parental combinations are indicated.

1648. Schlösser, L.-A. 635.64:581.145:575.11
Fruchtstandshöhe und Reifungsgeschwindigkeit bei Tomaten. **(The height of the fruit-bearing branches and the rate of ripening in the tomato).**
Züchter 1938 : **10** : 132–36.

The experiments were made on homozygous strains of the wild species *Lycopersicum cerasiforme* and *L. racemigerum* and on varieties of the cultivated tomato, *L. esculentum.*
Investigations showed that in the earlier ripening strains of the wild species the first and following inflorescences occur in much lower internodes than those of the later ripening strains.
Differences in the time of flowering and the rate of ripening were also observed in different strains.
Crosses were made between the races, both direct and reciprocal and in the F_1 of every cross the character of higher fruit bearing branches was almost completely dominant with monofactorial inheritance. By crossing the wild with the cultivated forms it is possible to select the homozygous recessive forms and so to obtain very early ripening strains.
A study of the developmental physiology of the reaction of the genes for height of the fruiting branches suggested a connexion with the relation between salts and carbohydrates which is very different in the different internodes.

1649. MacArthur, J. W. and
Butler, L. 635.64:581.47:575.11
Size inheritance and geometric growth processes in the tomato fruit.
Genetics 1938 : **23** : 253–68.

It is shown that the average fruit size in F_1, F_2 and back-cross hybrids approaches the geometric mean of the parents. It is suggested that the common belief that it approaches the arithmetic

mean is due to the small differences which are usually studied. The differences in fruit size produced by size genes linked with major factors or by fruit shape genes are consistent if they are measured as percentages but not if measured as arithmetical differences. The F_2 fruit size distributions are positively skewed, i.e. they show apparent dominance of small size; this is expected if size genes are cumulative geometrically.

Histological analyses show that fruit sizes and shapes are foreshadowed in the ovary primordium, being determined by differences in cell number and in cell expansion. Differences in cell number are brought about by different rates of cell division in the pre-anthesis period and differences in cell expansion occur only in the first few days after anthesis.

A working hypothesis of fruit size is advanced according to which size factors are considered as rate genes, one group governing rate of cell division and another group rate of cell expansion. Each type of factor is geometrically cumulative. It is also pointed out that less emphasis should be placed on lack of dominance in size inheritance, as many typical recessive mutants affecting size are known.

1650. Fleming, H. K. and
Myers, C. E. 635.64:581.47:575.11.061.6

Tomato inheritance, with special reference to skin and flesh color in the orange variety.

Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 609–24.

The inheritance of fruit skin colour and flesh colour and also of plant habit was studied in the crosses Golden Dwarf Champion x Connecticut Orange and Connecticut Orange x Burpee Self-Pruning. Golden Dwarf Champion has dwarf habit, colourless skin and yellow flesh, Connecticut Orange standard (indeterminate) habit, yellow skin and orange flesh and Burpee Self-Pruning determinate habit, colourless skin and red flesh.

The standard habit was dominant in each cross, giving a 3 : 1 ratio in F_2 and 1 : 1 in back-crosses in each case.

The F_2 results for skin and flesh from the first cross did not fit the hypotheses based on previous workers' findings, though the results from the second cross and from the back-crosses did so. The following scheme is proposed to explain all the results; it is believed to agree better with the biochemical findings on pigments in the tomato:—

For skin colour three factors are proposed, *Y* producing a yellow flavone, *V* producing yellow carotinoid pigments and *X* a dominant inhibitor of *V*. Golden Dwarf Champion is *XXVVyy* (colourless), Connecticut Orange *xxvv*YY (yellow) and Burpee Self-Pruning *XXvvyy* or *xxvvyy* (colourless).

For flesh colour two "basic colour" factors are proposed, *T* and *R*. *T* produces orange, *R* yellow and *TR* red, while *tr* is yellow. A multiple series of modifiers M_1M_2, etc. change a "basic" yellow to a "synthetic" orange or a "basic" orange to a "synthetic" red. The action of these modifiers is inhibited by two factors *G* and *K*. *G* inhibits the modification of orange to red and *K* the modification of yellow to orange. Assuming two pairs of modifiers the parental genotypes are as follows:—Golden Dwarf Champion $ggKKm_1m_1M_2M_2ttRR$, Connecticut Orange $GGkkM_1M_1m_2m_2TTrr$ and Burpee Self-Pruning $GGKKm_1m_1M_2M_2TTRR$. There are, however, probably at least four modifiers.

1651. Yarnell, S. H. and
Hawthorn, L. R. 635.64–2.112–1.521.6:575(76·4)
635.64 Summerset

Breeding tomatoes to extend the fruiting season.

Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 585–89.

The small fruited type of tomato continues to set fruit under the conditions of high temperature, low humidity and low soil moisture obtaining in summer in Texas, but its fruit has only a limited use because of its small size. To combine larger fruit size with this adaptation to summer conditions crosses between small and large fruited types and back-crosses to the latter have been used, with some success. From a selection of Bonny Best x Red Cherry, back-crossed to Bonny Best a strain has been selected at the Winter Garden Station and is soon to be distributed under the name Summerset.

1652. TATEBE, T. 635.646:581.162.3
(On pollination in the eggplant).
J. Hort. Ass. Japan 1938 : **9** : 61–69.
Flowers usually open about 4.30 to 5 a.m., though some open in the afternoon. Short-styled flowers are abortive. Natural pollination on sunny days occurs between 7 and 10 a.m., later on cloudy days. The stigmas are receptive from a day before anthesis to two days after. As judged by germination tests pollen of the variety Ōserikawa could be stored for two days, that of variety Mogi only for one.

1653. 635.648:575(76.3)
MILLER, J. C. and 635.648 Louisiana Velvet
WILSON, W. F. 635.648:575.11
A preliminary report on okra breeding in Louisiana.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 551–53.
By selection and inbreeding several promising strains of different types of okra (*Hibiscus esculentus* L.) have been isolated at the Louisiana Experiment Station and a strain of the Velvet or Lady Finger type is ready for distribution under the name Louisiana Velvet.
Inbred lines have also been used for hybridization and the inheritance of certain characters is being studied. Angular pods and round pods give a peculiar type of blending in F_1, the top three-quarters or more of the fruit being angular and the bottom round. In F_2 15 angular : 1 round were obtained, the degree of angularity being very variable. The early fruits of a plant are often more angular than the later.
The study of the inheritance of spines on the fruits has been complicated by the fact that strains which are spineless in the early part of the season are spiny later.
Crosses between tall and dwarf strains give an intermediate F_1 and 1 : 2 : 1 segregation in F_2.

1654. COUTINHO, L. de Azevedo 635.651:576.356.2:537.531
Breves referências sôbre "pontes anafásicas" em material irradiado de "*V. Faba*, L.". (**Brief notes on "anaphase bridges" in irradiated material of *V. Faba* L.**).
Rev. Agron., Lisboa 1937 : **25** : 32–37.
In material treated with X-rays dicentric chromosomes were produced by the union of two chromosomes, the centromeres of which passed to different poles. A number of fragments of irregular shape were observed, suggesting that the two chromatids of the chromosomes uniting had fused at different loci.

1655. MORSE, W. J. 635.655:575(73)
Soybean variety studies of the United States Department of Agriculture.
Proc. Amer. Soybean Ass., Ill. 1937 : Sept. 14–16 : 16–18.
The very local adaptation of soya bean varieties is stressed and a brief outline of the extensive introduction work of the United States Department of Agriculture with this crop is given. More than 10,000 introductions from the Orient, Siberia and the Indies have been made and at the present time more than 2,500 distinct varieties have been collected. These represent a wide range of variation in time to maturity, adaptation, size, shape, colour and composition of seed, suitability for different uses and plant characters. Extensive breeding work is carried on at Arlington Farm, chiefly selection work, though hybridization, especially with the wild soya bean has been started. Oil and protein studies are conducted along with the breeding work and though oil and protein content tend to be negatively correlated one outstanding strain has 20·94 per cent oil and 50·1 per cent protein. Iodine numbers of the oil range from 118 to 143 for domestic varieties and 155 for the wild soya bean.
The Bureau of Home Economics is co-operating in cooking quality studies of different varieties.

1656. Woodworth, C. M. 635.655:575.11
Recent results in soybean breeding and genetics.
Proc. Amer. Soybean Ass., Ill. 1937 : Sept. 14–16 : 44–48.
Brief accounts are given of the chlorophyll deficient types and some of the work on linkage (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 1366). The inheritance of number of seeds per pod is being studied and was found to be determined by multiple factors. Though a certain amount of transgressive segregation occurs in F_2 it does not seem possible to establish lines outside the range of the parents. A strain producing almost exclusively one-seeded pods has been discovered.
Segmental interchange giving rise to semi-sterility has been observed, in one case arising as a result of radium irradiation.
The method of bulked hybrid populations is used in breeding soya beans.

1657. Cartter, J. L. and Milner, R. T. 635.655:581.192:575(73)
Work of the agronomic and analytical divisions of the U.S. Regional Soybean Industrial Products Laboratory.
Proc. Amer. Soybean Ass., Ill. 1937 : Sept. 14–16 : 12–15.
The laboratory maintains extensive selection nurseries in the soya bean-producing States. Selections are studied for desirable agronomic characters and seed analysed to discover promising chemical characteristics. Promising strains are further tested for yield and general economic value. Hybridization work is also in progress.
The protein content, oil content and iodine number of the oil of some soya bean varieties are given.

1658. 635.656:575(47.1)
Pesola, V. A. 635.656 Kaleva
En ny ärtsort "Kaleva". (**A new variety of pea "Kaleva"**).
Tidskr. Landtm. 1938 : **20** : p. 93.
The "Kaleva" pea, an early, green variety selected from a land variety, is described.

1659. Lamprecht, H. 635.656:581.47:575.11
Über Hülseneigenschaften bei *Pisum*, ihre Vererbung und ihr züchterischer Wert. (**On the pod characters of *Pisum*, their inheritance and their breeding value**).
Züchter 1938 : **10** : 150–57.
A review of the work done on the genes determining the characters for colour, form and size and sclerenchymatous elements in the pod of *Pisum sativum*.
For the normal green pod colour the genes *Gp* and *O* in the dominant condition and P_1 in the recessive are necessary. The gene *Gp* in its double recessive form gives a light yellow pod colour as well as a pale yellow to the petals and pedicels and its expression is dependent on the recessiveness of P_1. *O* in its double recessive forms produces an increasing yellow colour in pods that start development as yellowish green. Three allelomorphs of this gene have been identified —O — o_y and o_r. The recessive form also changes the green colour of the cotyledons to a pale yellow and is dependent on the recessiveness of P_1.
P_1 in its dominant form determines a purple colour of the pod. The author prefers the symbol *Pur-pur*$_a$-*pur*$_b$-*pur* for the four allelomorphs of this series as *P* has already been used for a gene determining the development of the pod membrane.
A number of genes are known for the determination of pod form and size.
Bt produces a blunt ended pod and *bt* a sharp end. *Cp* in the dominant condition gives a straight pod, in the recessive condition a curved pod.
N in the double recessive form produces a specially thick pod wall; *nn* pods are always shorter than *N* pods.
Con in the double recessive condition gives a convex curvature of the basal suture. *Con* is completely dominant to *con*.

Crosses were made to determine the form of the combination *nn concon.* Line 127 from Pois Sabre, *BtBt CpCp NN concon PP VV* was crossed with Line 110 from Kungsärt *Bt Bt Cp Cp nn ConCon PP vv.* The F_1 plants had straight blunt pods with a thick membrane. In the F_2 there was found a new type with a straight *nn* pod. Further investigations showed that this was the recessive *concon nn* type. Monofactorial segregation was established for *N, Con* and *V, N* and *Con* and *N* and *V* are probably inherited independently. *Con* and *V* are, however, linked with a crossover value of 27·53 per cent. *Le* (for height) is also linked with *Con* and *V.*
P gives a thin membrane and *V* a membranous strip along the basal and dorsal sutures. *V* shows a tendency towards mutation in the direction $v \rightarrow V$.
The value of combination of these genes in breeding work is discussed.

1660. SINGLETON, W. R. and 635.67:575.12(74.6)
JONES, D. F. 633.15:575.12(74.6)
Sweet corn trials at Mt. Carmel, Connecticut, 1937.
Rep. Progr. Genet. Dep. Conn. Exp. Sta. Pp. 6. (Mimeographed).
Information is given on the performance of sweet corn hybrids, two-way, three-way and top crosses, with indication of the source of seed, where known.

1661. 635.67–1.421:631.551
HABER, E. S. 633.15–1.421:631.551
The effect of maturity on sweet corn yield tests.
Proc. Amer. Soc. Hort. Sci. (1937) 1938 : **35** : 566–68.
In sweet corn yield tests harvesting, if carried out at the canning stage must be done quickly, owing to the rapid change in moisture content at this stage. If left to the "dry ear" or seed stage there is much less need for quick work. From an experiment in randomized blocks in which half the replications were harvested at the canning stage and half at the seed stage it is concluded that if comparisons between strains are to be accurate they should be harvested at the proper stage. For preliminary tests, however, harvesting at the seed stage can be used, for major differences will not be obscured.

1662. 635.677:575.12(77.6)
633.15:575.12(77.6)
HARRIS, H. L. 635.677 Minhybrid 250
Minhybrid 250 popcorn.
Ctry Gent. 1938 : **108** : p. 70.
Bred by the Minnesota Agricultural Experiment Station this is the first hybrid popcorn released.

BOOK REVIEWS

519.24:575:633
519.24:631.421

NEYMAN, J.

Lectures and conferences on mathematical statistics.

Published by Graduate School, U.S. Dep. Agric., Washington 1938 : $1.25. Pp. 160. illus.

During his visit to the Department of Agriculture at Washington, D.C., Dr J. Neyman, Reader in Statistics of the University of London, delivered a series of lectures, and attended a number of conferences. These ranged over a wide field in the domain of mathematical statistics and its applications, and the manual under review, prepared by the author with the editorial assistance of W. Edwards Deming, of the United States Department of Agriculture, will be read with interest by all statisticians. Two sections should be of special interest to the plant breeder. These are:

(1) *On randomized and systematic arrangements of field experiments* (*pp. 49–65*). The author shows that while one mathematical theory (or model) is appropriate for randomized trials, another may be devised for use with trials of a systematic nature. He illustrates from the half-drill strip method, and describes the work of Barbacki and Fisher in testing the validity of the *t*-test calculated from such data. He further refers to the work of Chandra Sekar, in which "Student's" new method was compared on uniformity trial data with Weyman's method of parabolic curves. Finally he extends the discussion to cases where the two treatments (or varieties) give real differences in yield, the previous methods being merely the testing of a null hypothesis. The author concludes that lack of randomization is not by itself ruinous to statistical tests, but points out certain safeguards that have to be borne in mind.

(2) *On certain problems in plant breeding* (*pp. 67–88*). This section deals with a number of interesting general problems, but as the author is describing the work of Tang, since published in Biometrica, it need not be further particularized here. Suffice to say that the publication in accessible form of the material of these informal, but informative discussions, should be of great value to the plant breeder. The explanation is lucid throughout, and the book is illustrated by diagrams and explanatory calculations.

J. W.

575:633

Spragg memorial lectures on plant breeding. (First Series). Published by the Department of Farm Crops, Michigan State College, East Lansing 1937 : Pp. 86.

Frank Azor Spragg, who was plant breeder at Michigan Agricultural Experiment Station and who bred Red Rock wheat, Rosen rye, Wolverine and Worthy oats, Robust beans and Hardigan alfalfa, was killed in a motor accident in 1924. Since 1930 annual memorial lectures have been held in his honour at Michigan State College and the booklet under review contains the first seven of these lectures. The eighth, published separately, has been reviewed elsewhere (cf. Abst. 1527).

The lectures reprinted in the booklet before us are as follows:—

Love, H. H. *Contribution of plant breeding to the agriculture of the United States.* (*pp. 5–16*).

A brief historical account of the breeding work in the U.S.A. on the major crops.

Kiesselbach, T. A. *New crops for old.* (*pp. 17–32*).

Dr Kiesselbach describes and illustrates with examples the introduction of new crops and their improvement by breeding.

Emerson, R. A. *Heredity and environment.* (*pp. 33–41*).

Examples are given to illustrate the interaction of heredity and environment in determining characters and the application of this concept to human beings is discussed.

Parker, J. H. *Disease resistance in crop plants.* (*pp. 42–48*).

Includes a brief survey of some of the American work on breeding disease-resistant cereals.

Hayes, H. K. *The role of plant breeding in crop improvement.* (*pp. 49–56*).

Dr Hayes gives a brief account of the methods of plant breeding and emphasizes their dependence on genetic principles.

Jones, D. F. *The life and work of Luther Burbank.* (*pp. 57–76*).
A brief, critical biography of the famous plant breeder. Though Burbank owed much of his fame to successful publicity and made no important contribution to knowledge in the field of natural science, he has to his credit many improved fruits and flowers and also the interest he aroused in plant breeding.

Kirk, L. E. *Improvement of pasture grasses and legumes.* (*pp. 77–86*).
An account of the breeding of forage crops.

FORD, E. B. 575.1
The study of heredity.
Thornton Butterworth, Ltd., London 1938 : 2s. 6d. Pp. 256. 5 figs.
Brief exposés of genetics fall in general into two classes, one more technical and intended for students of the biological sciences, the other less technical and intended for the general public. Though the standard reached in most of the numerous examples of either of these classes is regrettably low, Grüneberg's recent text for medical students on "Elementary Genetics" (Cf. "Plant Breeding Abstracts", Vol. VIII, p. 86) is praiseworthy and in the book under review we have its counterpart for the general public, for Mr Ford's account is also accurate and up to date.
The first chapter gives an account, based on Darlington, of chromosome behaviour and the next describes Mendelian inheritance. There follows a chapter on sex inheritance, one on mutation and a fifth on the nature of heredity. Chapter six deals with variation, chapter seven with the physiological action of genetic factors and chapter eight with selection. The two final chapters are on practical application and human heredity and on evolution respectively. A glossary, short bibliography and index are provided.
The author strikes a nice balance between the popular and the technical and brings out well the wide importance of genetics. This is a book that can be recommended to the general public and which could be read with profit by most biologists.

SHULL, A. F. 575.1
Heredity.
McGraw-Hill Publishing Co., Ltd., London 1938 : 3rd ed. 21s. 0d. Pp. xvii + 442. 168 figs. 4 tables.
According to the preface to the first edition this textbook is based on a lecture course given to large classes of college students many of whom have no previous training in biology. This, the third edition, is stated to have been almost completely rewritten.
It begins with a brief historical survey and then gives an account of such topics as cellular structure and embryology for the benefit of the non-biologist. Mendelian inheritance is then described, followed by chapters on non-mendelian inheritance and on sex. The remainder of the book is concerned with applications of genetics and deals with evolution, heredity in man, practical applications, eugenics and the problems of population, race and immigration. An appendix deals with the inheritance of quantitative characters and introduces some simple statistics. Questions and problems are provided to test the reader's memory and there is a fairly extensive bibliography and an index.
The book appears to be suitable for the type of reader mentioned in the preface, in particular those who are interested in human heredity and could be recommended to the layman who wants to know more about heredity than is to be found in the average small book written for his benefit.

STUBBE, H. 575.24
Genmutation I. Allgemeiner Teil. (**Gene mutation I. General part**).
Handb. Vererbungsw. 1938 : RM. 48.† Lieferung 23 (II, F) : Pp. 429. 90 illus. 130 tables. (Gebrüder Borntraeger, Berlin).
The topic of mutation is of fundamental importance for genetics, for mutation produces the differences with which geneticists work. In the book before us we have the first part of what promises to be a thoroughly comprehensive treatise on gene mutation.

† 25 per cent reduction outside Germany.

Beginning with an interesting historical survey starting at 1590, when the laciniate form of *Chelidonium majus* was found, the author proceeds to give an account of the qualitative aspects of gene mutation and gene mutability. This is followed by a section on the quantitative study of mutation phenomena and there is a final section on the nature of the gene. An extensive bibliography is provided and the book ends with a compendious tabular survey of the mode of appearance of mutations. In a book which is so obviously valuable for reference the absence of an index is rather disappointing, but this lack will presumably be remedied when the second part (spezieller Teil) appears.
While the author does not claim to have covered every reference to mutation it is probably correct to say that he has touched upon every conceivable aspect of his subject and deserves the gratitude of geneticists for the immense labour such a compilation must have required.

REINIG, W. F. 575.4:576.1:551.569
Elimination und Selektion. Eine Untersuchung über Merkmalsprogressionen bei Tieren und Pflanzen auf genetisch und historisch-chorologischer Grundlage. (**Elimination and selection. An investigation of character progressions in animals and plants from a genetical, historical and chorographical basis**).
Gustav Fischer, Jena 1938 : RM. 8.† Pp. viii + 146. 29 figs. 13 tables.

The question which this investigation seeks to answer is whether the hitherto recognized evolutionary factors, mutation and selection, as well as the action of the subsidiary factors, isolation and separation, are sufficient to explain the origin of all the variation phenomena present within a phylogenetical unit.
The main outlines of the work are as follows:—Part one deals with the historical, genetical and chorographical basis; part two with the dynamical chorographical basis of variability; part three describes the geographical progression of the characters and is illustrated by examples from birds and mammals; in part four, selection and elimination are briefly discussed. The author's conclusion is that elimination must be considered as a factor to rank with mutation and selection in evolution.

CUÉNOT, L. 576.1
L'espèce. (**The species**).
Gaston Doin et Cie, Paris. 1936 : 40 fr. Pp. vi + 310. 42 figs.

This volume is one of a series devoted to general biology and intended for anyone interested in the subject, whether layman or professional.
The first part is devoted to a brief history of the species concept; the second reviews the cytological data for the constitution of the species; part three is a consideration of the units used by systematics in which various terms employed are described and defined; part four gives a short account of various genera and their species, both plant and animal; in part five data on the origin of species are reviewed and finally the difficulties encountered in making definitions are discussed.
While avoiding profound philosophical treatment much useful data are provided in this handy volume.

BEER, G. R. de (Editor) 576.12
Evolution. Essays on aspects of evolutionary biology.
Clarendon Press, Oxford 1938 : 15s. 0d. Pp. viii × 351. illus.

To mark the appreciation by zoologists of nearly half a century of work by Professor E. S. Goodrich, G. R. de Beer decided to produce a Congratulatory Volume to be presented to him on the occasion of his seventieth birthday. The book consists of nineteen essays by past or present colleagues or pupils of Professor Goodrich, on different aspects of the general theme, Evolution, a field in which Professor Goodrich has always been deeply interested.
Though the book is written primarily by and for zoologists it is of considerable interest for biologists in general. In virtue of the high standard of the contributions one feels that the volume will perform the useful service of making available in an easily assimilated form the present-day views of zoologists on evolution. The reader who is more particularly interested in evolution in the plant kingdom will find many interesting points to compare and contrast,

particularly in those essays which deal with the mechanism of evolution. From this point of view we may mention the following essays: "The present standing of the theory of sexual selection" by J. S. Huxley; "The genetic basis of adaptation" by E. B. Ford; "The nature of interspecific differences" by J. B. S. Haldane; "The formation of species. Methods of studying the early stages of evolutionary divergence in animals" by O. W. Richards; "Animal numbers and adaptation" by Charles Elton; "The evolution of breeding seasons" by J. R. Baker; "Bacterial strains, and variation" by H. G. Thornton.
The book concludes with a list of the scientific works of E. S. Goodrich, an index and a list of subscribers.

DAVIES, A. M. 576.12
Evolution and its modern critics.
Thomas Murby and Co., London 1937 : 7s. 6d. Pp. xii + 277. 30 figs.
This book is a restatement and discussion of the evidence for evolution. Primarily designed as a reply to Mr D. Dewar's "Difficulties of the Evolution Theory", published in 1931, it also deals with criticisms raised by other writers, including some of the objections raised by the late G. K. Chesterton and by Sir Ambrose Fleming. A glossary, bibliography and an index are provided.

ELLIS, C. and
SWANEY, M. W. 581.09
Soilless growth of plants. Use of nutrient solutions, water, sand, cinder, etc.
Reinhold Publishing Corporation, New York 1938 : 13s. 6d. Pp. 155. 58 figs. (Chapman and Hall, Ltd., London).
A suitable sub-title for this little book would be "Water Culture for the Million". The application of water culture methods to horticultural production was apparently developed by Gericke, of the University of California (though he is not mentioned in the book under review) and has achieved some popularity in the U.S.A.
The most useful parts of the book are those giving accounts of apparatus and formulae for culture solutions. Both home and commercial applications are considered. Other topics, such as plant hormones and chromosome doubling by colchicine are very briefly treated, but the standard of accuracy here and throughout the book is so low that it can only be recommended for those requiring practical details of the water culture methods, which may have some interest for plant breeders.
An index is provided and there are numerous illustrations.

HUTCHINSON, J. and
DALZIEL, J. M. 581.9(66)
Flora of West Tropical Africa. Vol. I, Parts 1 and 2.
Crown Agents for the Colonies, London, 1927 and 1928 : 8s. 6d. each. Pp. x + 523. Figs. 1–177.

HUTCHINSON, J. and
DALZIEL, J. M.
Flora of West Tropical Africa. Vol. II, Parts 1 and 2.
Crown Agents for the Colonies, London, 1931 and 1936 : 8s. 6d. each. Pp. 651. Figs. 178–381.

DALZIEL, J. M.
The useful plants of West Tropical Africa. (Being an appendix to the Flora of West Tropical Africa by J. Hutchinson and J. M. Dalziel.)
Crown Agents for the Colonies, London, 1937 : 18s. 0d. Pp. xii + 612.
The Flora of West Tropical Africa, of which the first part of Vol. I was published in 1927 and Part 2 of Vol. II in 1936, has now been completed with the publication in 1937 of an appendix "The useful plants of West Tropical Africa."
In his preface, Sir Arthur Hill points out the need for and value of such handy regional floras for botanists, foresters and agriculturists and it is hoped to bring out a similar flora for the Tropical East African Colonies.

The present flora is arranged on the new system of classification adopted by Mr Hutchinson in "The families of flowering plants"; it is provided with illustrations of the families, as represented by the more important genera and to save space and to facilitate the determination of the species, the text takes the form mainly of a descriptive key.
In the Appendix some of the native plants in common use are recorded with a brief account of their properties and utilization. Vernacular names are given wherever these have been accurately determined.

SMITH, G. M. 582.1
Cryptogamic botany. Volume I. Algae and fungi.
McGraw-Hill Publishing Co., Ltd., London 1938 : 24s. 0d. Pp. viii + 545. 299 figs.
SMITH, G. M.
Cryptogamic botany. Volume II. Bryophytes and pteridophytes.
McGraw-Hill Publishing Co., Ltd., London 1938 : 18s. 0d. Pp. vii + 380. 224 figs.

Designed for students who have had an introductory course in botany and wish to make a more detailed study of the cryptogams, this book gives a straightforward, competently written and well illustrated account of the algae, slime moulds, fungi, lichens, Bryophyta and Pteridophyta. The method adopted has been to give full accounts of representative series rather than to seek to mention everything. The relative amounts of space devoted to the main groups are interesting. The algae occupy about 340 pages, the fungi about 150, the bryophytes 114 and the pteridophytes about 250.
Each chapter has its bibliography and there is a useful index.

63:025.4
Système de classification des sciences agricoles. (**Classification scheme for agricultural science**).
Inst. Int. Agric., Rome 1934 : Pp. xxv + 171.

This is the scheme of classification in use in the Library of the International Institute of Agriculture in Rome and has been specially devised for an agricultural library.
The main groups are represented by the letters of the alphabet. The groups are then sub-divided numerically and for further classification analytical and geographical auxiliary sub-divisions are provided.
The main classification is given in three languages, French, English and German as well as the geographical and analytical sub-divisions and there is an alphabetical index in each language.
No classification is perfect but this has the recommendation of having been tested and found satisfactory in practice.

GRAM, K.,
JENSEN, Hj. and
MENTZ, A. 633/5:581.6
Nytteplanter. (**Economic plants**).
Gyldendal, København 1937 : 9.75 kr. Pp. 503. 300 figs.

Descriptions of the economic plants of the world and their uses. The plants are arranged under the headings –food plants, aromatic plants and stimulants, medicinal and poisonous plants, plants for technical purposes and plants for the improvement of the soil.
The book is amply illustrated and has a good index and a short bibliography.

MCDONALD, J. (Editor) 633.73:575(67.62)
Coffee in Kenya. By the staff of the Scott Agricultural Laboratories and the Agricultural Economist, Department of Agriculture, Kenya, with a contribution by the Director of the British East African Meteorological Service.
Government Printer, Nairobi 1937 : 5s. 0d. Pp. vi + 210. 28 pls. 3 tables. 5 diagrams.

Although coffee was first introduced into Kenya in 1896 it was not until after the war of 1914–1918 that it became the main economic crop of the Colony. Only since then has research

been carried on and the present report reviews the results already achieved and the problems still to be solved.
The work includes accounts of the climate and soils in relation to coffee growing, cultural practice and factors, treatment, pests and diseases and finally the economics of coffee cultivation.
Single-plant selection is practised and the success of methods of vegetative propagation has made hybridization a practical possibility.
Crosses have now been made between types of *C. arabica*, *C. eugenioides* and *C. mufindiensis* and it is hoped that many problems may be solved by this means.

Wettstein, W. v. 634.972.3:575
Die Vermehrung und Kultur der Pappel. (**The propagation and cultivation of the poplar**).
J. D. Sauerländers, Frankfurt am Main 1937 : Pp. 31.

The present economic value of poplar wood for various purposes has increased the need for improvement both in quality and quantity and to this end this small pamphlet has been compiled by an author well known for his researches on poplar and other trees.
There are descriptions of the chief species of economic importance, notes on propagation both vegetative and by seedlings and instructions for their cultivation. There is a short list of diseases and pests and the measures for their control. In the section on breeding it is pointed out that only by breeding can qualitative improvement and resistance to disease and frost be obtained. The increased production, due to hybrid vigour in the crosses between systematically closely related species is of considerable importance but in the F_1 of crosses between more distantly related species dwarfing effects are observed.

Cansdale, G. S. 634.972.3:575.127.2:001.4
The Black Poplars and their hybrids cultivated in Britain.
University Press, Oxford 1938 : 3s. 6d. Pp. 52. 1 fig.

The Black Poplars are of considerable economic value and their increased cultivation is advised. Some research on the distribution of poplar canker among the species of poplar showed the confusion existing in the nomenclature of the various hybrid poplars now in cultivation and the present work is the result of a critical investigation of the species and hybrids of the Black Poplars found in Great Britain. To this end, the characters of use in identification are described, an historical review of the literature on the classification of the Black Poplars is given and the poplars and hybrids of the section *Aigeiros* are specifically described.
Finally there is a key to the species and hybrids of *Populus* cultivated in Britain based on vegetative characters as far as possible.

Tapley, W. T.,
Enzie, W. D. and
Eseltine, G. P. van 635.61/3(74.7)
The vegetables of New York. Vol. I, Part IV: The cucurbits.
Rep. N.Y. St. Agric. Exp. Sta. 1937 : Pp. 131. illus.

The earlier parts of this work have already been reviewed (Cf. "Plant Breeding Abstracts", Vol. V, Absts 690 and 1154). The part under review describes the varieties of squashes and pumpkins (*Cucurbita maxima*, *Cucurbita Pepo* and *Cucurbita moschata*), musk-melons (*Cucumis Melo*) and cucumbers (*Cucumis sativus*) cultivated at present or in the past on a commercial scale in New York State. The same lines as earlier parts are followed and accounts of the history and systematic botany of the cultivated Cucurbits are given as well as the varietal descriptions. Bibliographies and an index are provided. The standard of production is maintained at the high level characteristic of this work and the full-page coloured photographs are extraordinarily good.

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